User Manual

Allen-Bradley

PowerMonitor 1000 Unit

Catalog Numbers 1408-TR1A-485, 1408-TR2A-485, 1408-EM1A-485, 1408-EM2A-485, 1408-EM3A-485, 1408-TR1A-ENT, 1408-TR2A-ENT, 1408-EM1A-ENT, 1408-EM2A-ENT, 1408-EM3A-ENT

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

	SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

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This manual contains new and updated information. Changes throughout this revision are marked by change bars, as shown to the right of this paragraph.

New and Updated Information

This table contains the changes made to this revision.

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Updated unit certifications, Appendix D	127

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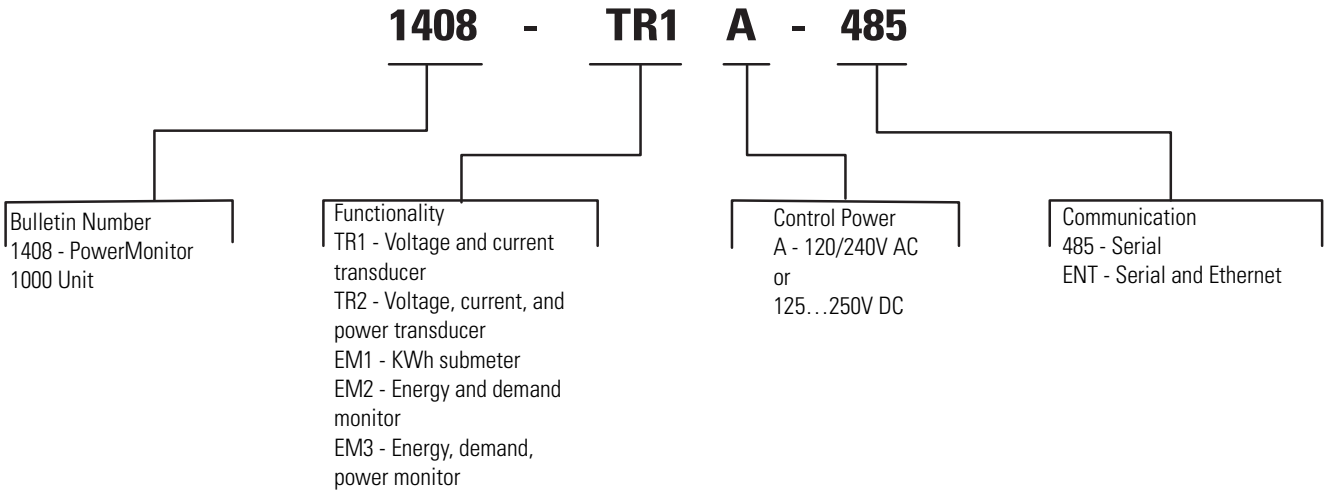
Before You Begin

Use this document as a guide to set up communication with the Bulletin 1408 PowerMonitor 1000 unit using other applications and controllers. This document is intended for advanced users. You should already be familiar with data communication and programmable controller messaging.

For further information on installing, wiring, connecting, applying power, and configuring your Bulletin 1408 power monitor, please refer to the PowerMonitor 1000 Installation Instructions, publication 1408-IN001.

Catalog Number Explanation


1408 - TR1 A - 485
Bulletin Number
1408 - PowerMonitor 1000 Unit
Functionality
TR1 - Voltage and current transducer
TR2 - Voltage, current, and power transducer
EM1 - KWh submeter
EM2 - Energy and demand monitor
EM3 - Energy, demand, power monitor
Control Power
A - 120/240V AC or 125…250V DC
Communication
485 - Serial
ENT - Serial and Ethernet

Who Should Use This Manual

You should have a basic understanding of electrical circuitry and familiarity with relay logic. If you do not, obtain the proper training before using this product.

Additional Resources

These documents contain additional information concerning related Rockwell Automation products.

Resource	Description
PowerMonitor 1000 Unit Installation Instructions, publication 1408-IN001	This publication gives product description and functionality.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

PowerMonitor 1000 Overview

Safety

Follow these advisories when using this product.

ATTENTION: Only qualified personnel, following accepted safety procedures, should install, wire, and service the power monitor and its associated components. Before beginning any work, disconnect all sources of power and verify that they are de-energized and locked out. Failure to follow these instructions may result in personal injury or death, property damage or economic loss.

ATTENTION: Never open a current transformer (CT) secondary circuit with primary current applied. Wiring between the CT's and the power monitor should include a shorting terminal block in the CT secondary circuit. Shorting the secondary with primary current present allows other connections to be removed if needed. An open CT secondary with primary current applied produces a hazardous voltage, which can lead to personal injury, death, property damage or economic loss.

IMPORTANT The power monitor is neither designed for, nor intended for, use as a circuit protective device. Do not use this equipment in place of a motor overload relay or circuit protective relay.

About the PowerMonitor 1000 Unit

The power monitor is a compact, cost-effective, electric power and energy metering device intended for use in industrial control applications, such as destribution centers, industrial control panels, and motor control centers. It measures voltage and current in an electrical circuit, meeting revenue accuracy standards. It communicates power and energy parameters to applications such as RSEnergyMetrix, RSPower, and RSPowerPlus, over Ethernet or serial networks. The power monitor works with these software applications to address these key customer applications.

- Load profiling – log power parameters such as real power, apparent power, and demand, for analysis of power usage by loads over time
- Cost allocation – reporting actual energy cost by department or process to integrate energy information into management decisions
- Billing and sub-billing – charging users of energy the actual usage cost rather than allocating by square footage or other arbitrary methods
- Power system monitoring and control – display and control power flow and energy utilization

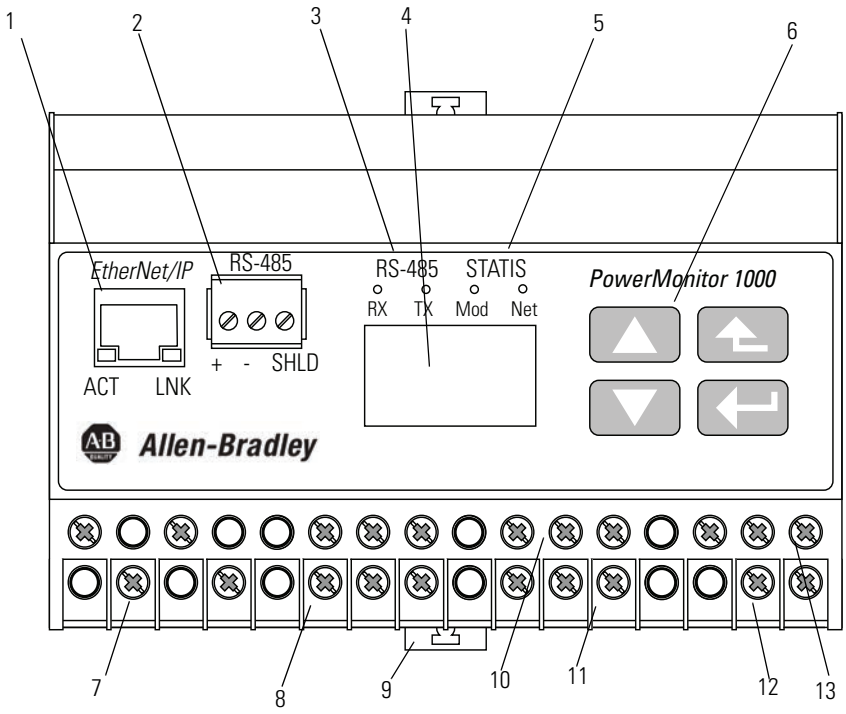
PowerMonitor 1000 Unit Features and Functions

The power monitor connects to the user's three-phase or single-phase AC power system directly or through instrument transformers (PTs and CTs). It converts instantaneous voltage and current values to digital values, and uses the resulting digital values in calculations of voltage, current, power, or energy.

The power monitor family includes five models:

- TR1 – Voltage and current transducer
- TR2 – Voltage, current, and power transducer
- EM1 – Basic real-energy monitor for sub-metering applications
- EM2 – Energy and demand monitor for main metering applications
- EM3 – Full-function power and energy monitor

Hardware Features



Feature	Description
1. Ethernet network port - standard RJ-45 jack with status indicators	Ethernet network port hardware is included on all models. The port functions only on units ordered with or upgraded to the Ethernet network. The following protocols and functions are supported. • EtherNet/IP • Modbus TCP • HTML Web page for configuration and data access • LNK indicator – Solid GREEN: IP link established – Off: no link established • ACT indicator – Flashing YELLOW: data present on Ethernet port – Off: no data activity present
2. Serial port - three-pin RS-485 connector	All models include RS-485 serial communication that support the following protocols and functions. • DF1 half-duplex slave • DF1 full-duplex • Modbus RTU slave • Configuration using the HyperTerminal communication tool • DH-485
3. Serial port status indicators	• TX indicator flashes YELLOW when data is being transmitted • RX indicator flashes YELLOW when data is being received
4. LCD	• Unit configuration • Data display
5. Module and network status indicators	• Module indicator – GREEN: Normal operation – Alternating RED/GREEN: Performing self-test – RED (solid or blinking): Initial power-up or failed self-test • Network indicator – GREEN: Ethernet connection established – Blinking GREEN: Ethernet port looking for a connection – RED: Duplicate IP address detected
6. LCD interface buttons	• Unit configuration • Data display navigation

Feature	Description
7. Voltage-sensing wiring terminals	• Direct connect up to 600V AC three-phase line-to-line • Maximum nominal line-to-ground voltage 347V • Use potential transformers (PTs) for higher voltages
8. Current-sensing wiring terminals	• Nominal input current 5 A • Use current transformers (CTs) to connect to power system
9. DIN-rail clips	• Top and bottom clips for mounting unit on DIN rail
10.Status-input wiring terminals	• Two internally-powered inputs • S2 can be used for demand period synchronization
11.Configuration-lock wiring terminals	• Wire together to prevent configuration changes
12.KYZ-output wiring terminals	• DPDT solid-state relay for signaling use
13.Control power and ground wiring terminals	• 120…240V AC, 50…60 Hz

Functionality by Model

The power monitor models differ by the data sets available to client applications.

This table indicates the measurements and functions available in each model.

Measured Parameters	TR1	TR2	EM1	EM2	EM3
Voltage	•	•			•
Current	•	•			•
Frequency	•	•			•
Voltage unbalance	•	•			•
Current unbalance	•	•			•
Real power, kW		•			•
Reactive power, kVAR		•			•
Apparent power, kVA		•			•
True power factor		•			•
Real energy, kWh			•	•	•
Reactive energy, kVARh				•	•
Apparent energy, kVAh				•	•
Real power demand, kW				•	•
Reactive power demand, kVAR				•	•
Apparent power demand, kVA				•	•
Projected KW demand				•	•
Projected KVAR demand				•	•
Projected KVA demand				•	•
Demand power factor				•	•
Logs					
Energy log			•	•	•

Measured Parameters	TR1	TR2	EM1	EM2	EM3
Min / max log	•	•			•
Load factor log				•	•
Time of use logs			•	•	•
Status log	•	•	•	•	•

Troubleshooting mode lets you enter a password-protected command that promotes your PowerMonitor unit to an EM3 model. This makes all measured parameters available for troubleshooting purposes.

Communication Overview

All PowerMonitor 1000 units come standard with an RS-485 serial communication port. Models with catalog numbers ending in -ENT are equipped with an Ethernet 10BaseT communication port. This section covers serial and Ethernet communication, the available protocols, and what protocols to use for your application.

What Can I Do Using Communication Networks?

When you use communication networks with the power monitor you can do the following things.

- Configure analog input parameters such as PT/CT ratios
- Configure communication parameters such as IP address
- Read real-time power and energy data
- Read energy logs

Serial Communication

The RS-485 serial communication port allows serial communication to your power monitor. This port can be configured to communicate using the protocols listed the this table.

Protocol	Applications
DF1 Half-duplex Slave	The DF1 Half-duplex Slave protocol may be used for point-to-point or multi-drop communication using a DF1 Polling Master driver for RSLinx software, or when using explicit messages from Rockwell Automation controllers communicating via DF1 Half-duplex Master.
DF1 Full-duplex	The DF1 Full-duplex protocol may be used only for point-to-point communication using a RS-232 DF1 driver for RSLinx software, or when using explicit messages from Rockwell Automation controllers communicating via DF1 Full-duplex.
Modbus RTU Slave	The Modbus RTU Slave protocol may be used for point-to-point or multi-drop communication with a client using the Modbus RTU Master protocol for PLC controller communication.
Auto-sense	With auto-sense selected, the RS-485 port switches among the available serial protocols based on the format of the packets the port receives.
DH485	The DH485 protocol may be used for point-to-point or multi-drop communication using a 1747-PIC/AIC+ driver for RSLinx software, or when using explicit messages from Allen-Bradley controllers or HMI (PanelView) terminals communicating via DH485.

TIP When configuring serial communication, users should verify that all serial devices wishing to communicate to the power monitor have the same communication rate, and the same data format.

DH485 Protocol

DH485 is a token-passing protocol that allows messaging by up to 32 nodes on a serial network. The master is the node that owns the token; only the master may transmit messages. When a node has completed transmitting messages, it passes the token to the next node.

The power monitor does not initiate DH485 data messages. When requested, it transmits reply messages to the initiator when it gets the token, and then passes the token to its successor.

TIP PowerMonitor 1000 units only support DH485 Local Link messages and do not support the Send and Receive Data (SRD) messages for DH485 non-token passing slave devices.

The DH485 protocol uses the same data table addressing as DF1 protocols. Please refer to the CSP file number column of PowerMonitor 1000 data tables.

The following configuration factors have a significant effect on network performance and should be considered when you plan a DH485 network.

- Number of Nodes - unnecessary nodes will slow the data transfer rate. The maximum number of nodes on the network is 32. Fewer nodes are better.
- Node Addresses - best to start node addresses at 0 and assign in sequential order. Controllers may not be node 0. Initiators such as personal computers should be assigned the lowest numbered addresses.
- Communication Rate - Higher is better. All devices must be at the same communication rate.
- Maximum Node Address - should be set as low as possible to reduce the time it takes to initialize the network.

Ethernet Network Communication

The Ethernet network communication port allows communication with your power monitor using a local-area-network (LAN). The Ethernet port may also be used to view the power monitor's internal webpage. This Ethernet port uses a static IP address only, and can simultaneously communicate using the protocols listed below. The Ethernet communication port supports 10 or 100 Mbps data rate, half-duplex, or full-duplex.

EtherNet/IP Protocol

The power monitor supports the EtherNet/IP protocol for communicating via Ethernet or EtherNet/IP drivers in RSLinx Classic software, or when using explicit messages from Rockwell Automation controllers communicating via Ethernet or EtherNet/IP network.

Modbus TCP Protocol

Modbus TCP protocol is also supported for communicating via Modbus TCP for communication.

TIP When configuring Ethernet communication, you should verify that IP addresses do not conflict with the existing infrastructure, and that subnet masks and gateways are properly set.

Set Up the PowerMonitor 1000 Unit

Although the power monitor ships from the factory with default settings, you need to configure it for your particular requirements. You may configure the power monitor using the LCD, the HyperTerminal communication tool, a Web interface, or other software. This section describes, in general, methods for setting up the power monitor.

Use Optional Software

RSPower, RSPowerPlus, and RSEnergyMetrix software (with the RT option) provide configuration interfaces for the power monitor, including the ability to upload, edit, download, and back up the unit configuration on a personal computer or server. Please refer to the applicable software user documentation or help files for information on configuring the power monitor using RSPower, RSPowerPlus, or RSEnergyMetrix software. Contact your local Rockwell Automation sales office or distributor, or visit http://www.rockwellautomation.com/rockwellsoftware/ for more information on available software packages.

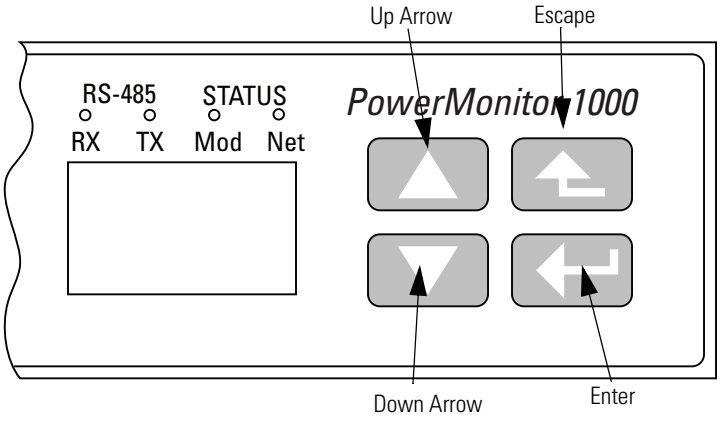
Use the LCD Screen

The power monitor has an onboard LCD for viewing and configuration. Buttons are provided to control the display. The display has three modes of operation.

- Display mode lets you select and view parameters including metering, event log, and self-test information.
- Program mode lets you change configuration parameters, with security against unauthorized configuration changes. Each power monitor is password protected.
- Edit mode lets you modify the selected parameters. In Edit mode, a highlight cursor appears under the value of the parameter being modified, starting at the right-hand (least significant) digit.

The diagram and table shows the LCD interface buttons and their functions.

Figure 1 - LCD Interface



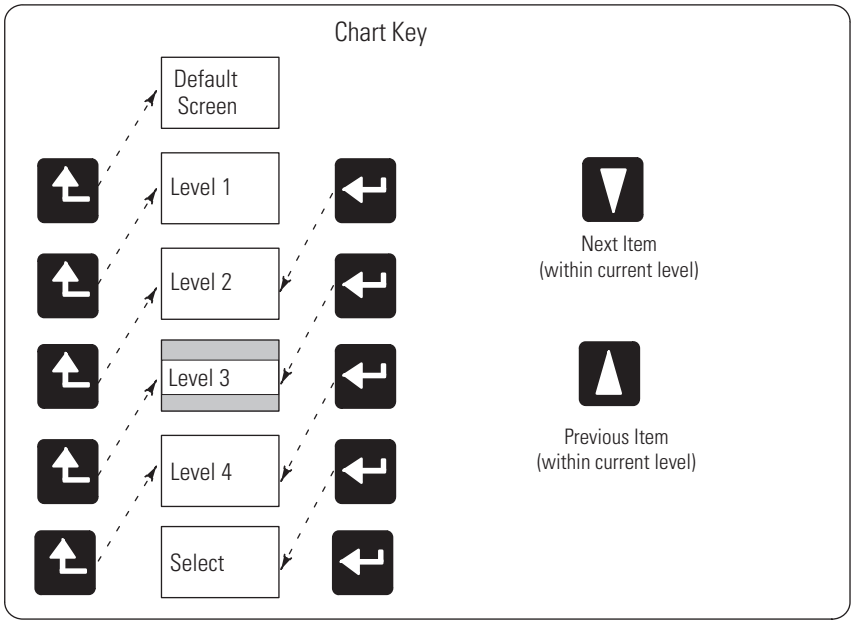
The buttons function differently in each mode. The power monitor enters into Display mode by default.

Button	Mode		
	Display	**Program**	**Edit**
Escape	Returns to parent menu At top menu, selects default screen		Cancels changes to the parameter and returns to Program mode
Up arrow	Steps back to the previous parameter or menu item		Increments the value of the highlighted digit
Down arrow	Steps forward to the next parameter or menu item		Decrements the value of the highlighted digit
Enter	Steps into a sub-menu or sets default screen	Steps into a sub-menu, selects the parameter to be modified or changes to Edit mode	Saves the parameter change and returns to Program mode
Up and down arrows together	Refreshes the display	No effect	Moves the highlight cursor one character to the left

User choices for display and configuration are organized in a hierarchical menu system within the power monitor.

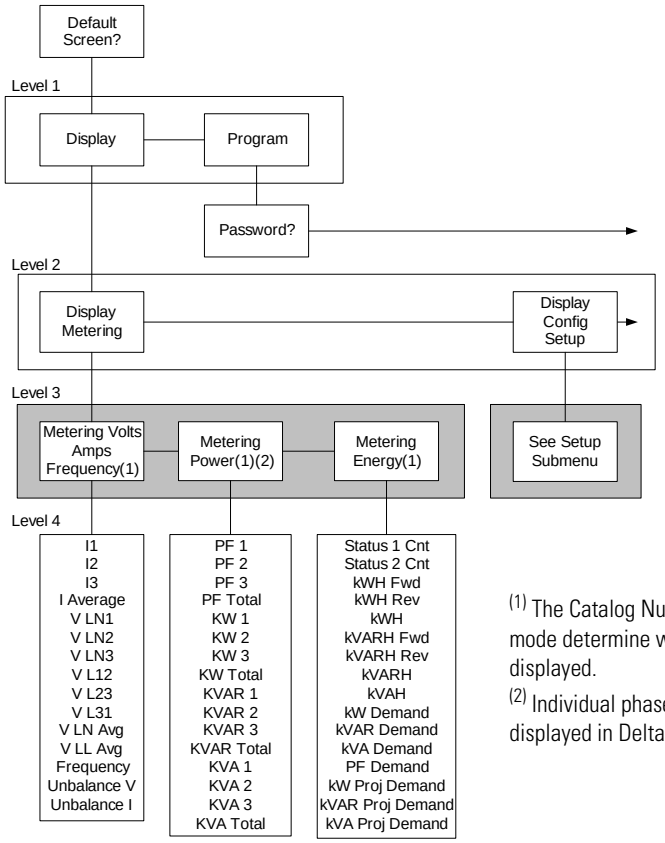
This diagram shows how to navigate in the display and configuration menu.

Figure 2 - Menu Navigation



LCD Screen Display and Configuration Menu Map

Figure 3 - Main Menu, Page 1



(1) The Catalog Number and Voltage mode determine which parameters are displayed.

(2) Individual phase parameters are not displayed in Delta modes.

Default Screen

The power monitor lets you select and navigate to a default screen. The default screen displays at startup and is displayed after the display has been dormant for approximately 30 minutes. To set the current screen as the default, press Enter and click Yes. If you're in another menu and want to get back to the default screen, continue pressing Escape until you are prompted To Default Screen? Click Yes to display the default screen.

Figure 4 - Main Menu, Page 2

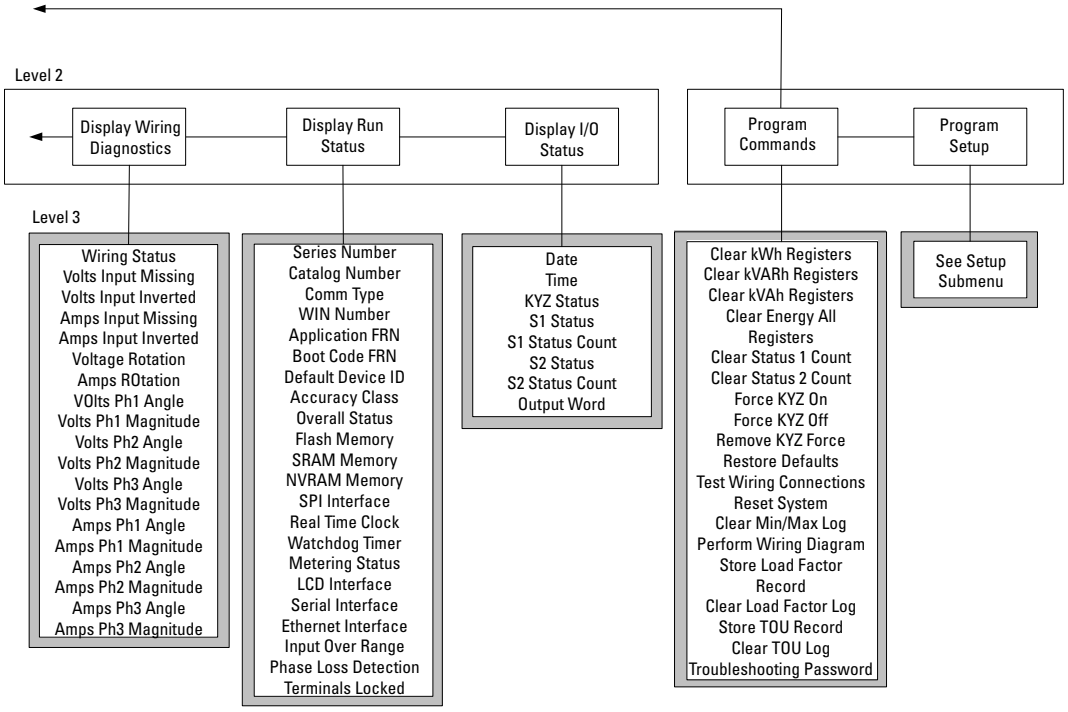
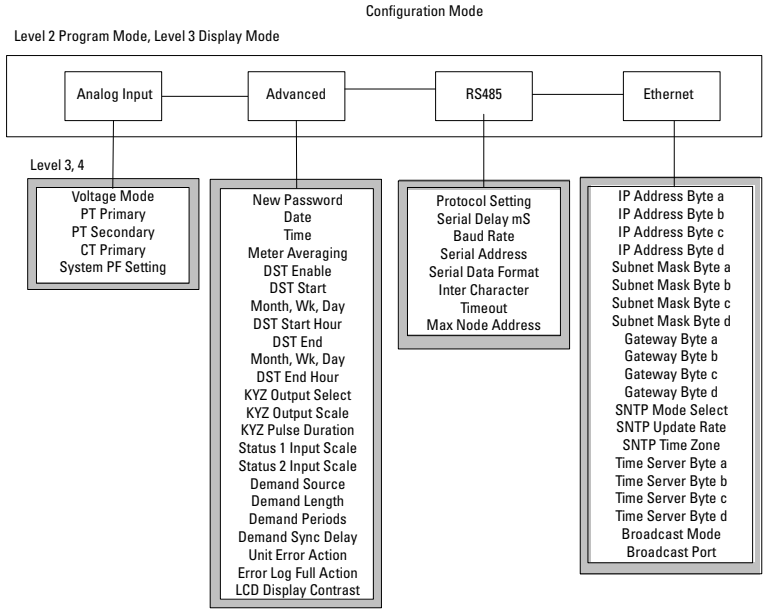


Figure 5 - Setup Submenu



Edit a Parameter

To edit a parameter, do the following:

- Press <up> or <down> to change the highlighted digit.
- Press <up> and <down> together to move the highlight cursor one place to the left, and press <up> or <down> to set the selected digit's value.

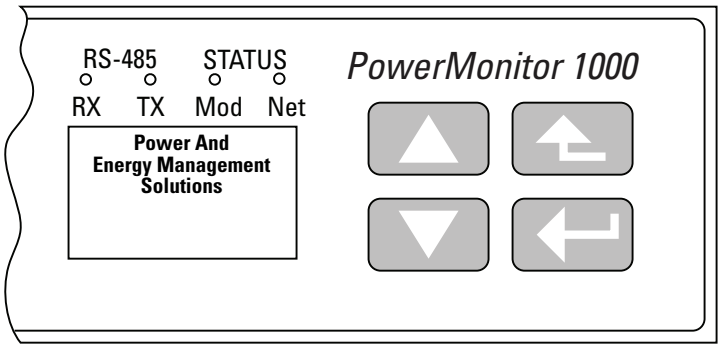
Continue in the same way until the correct value is entered then press <enter> when done.

Setup Example

This example steps through setting the unit date to demonstrate use of the display and buttons to navigate through the setup menu and make changes to parameters.

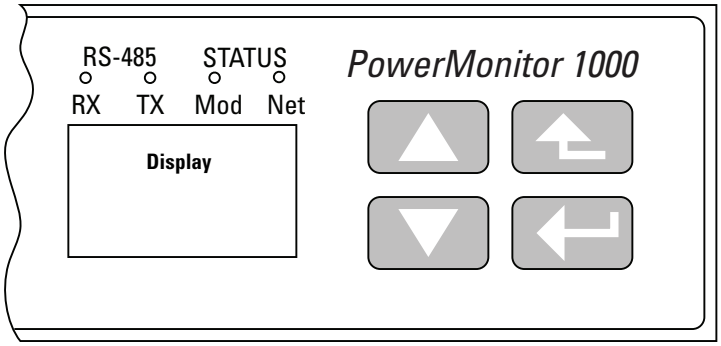
1. Navigate to the initial screen.

   The screen shown is the top level screen. If it is not present, press <escape> until it appears.



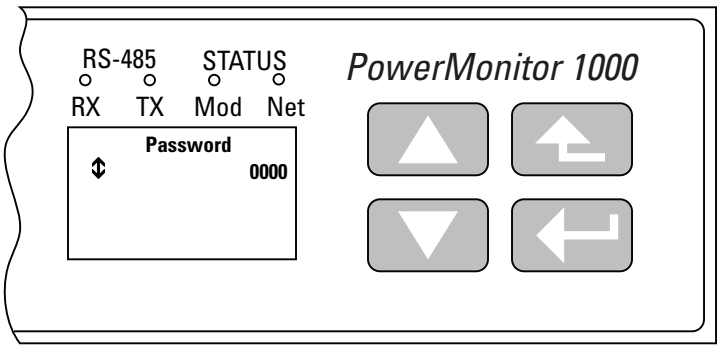
   If you press <escape> once too often, the To Default Screen? message appears. Press <escape> once more if this occurs.

2. Press <enter> and this screen appears.



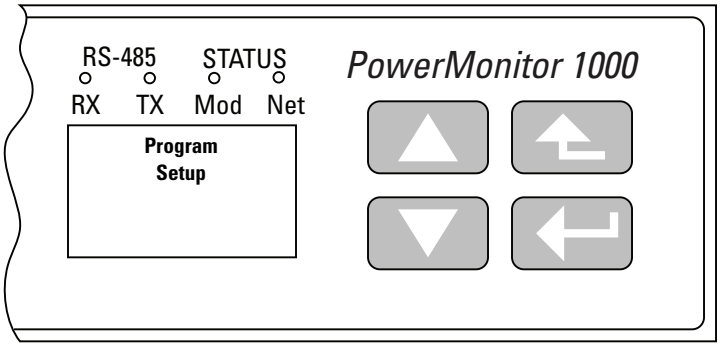
3. Press <up> or <down> once.

   Program appears in the display. Press <enter>.



4. Press <enter> if the password has not been changed from the default (0000).

   If the password has been changed, then enter the correct password.

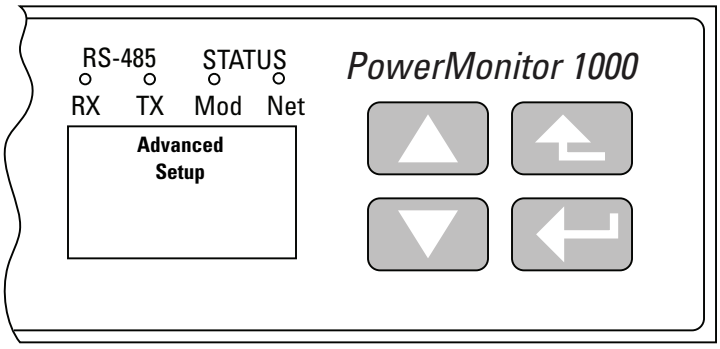


   When the correct password is entered, Program Setup appears in the display. The power monitor is now in Program mode.

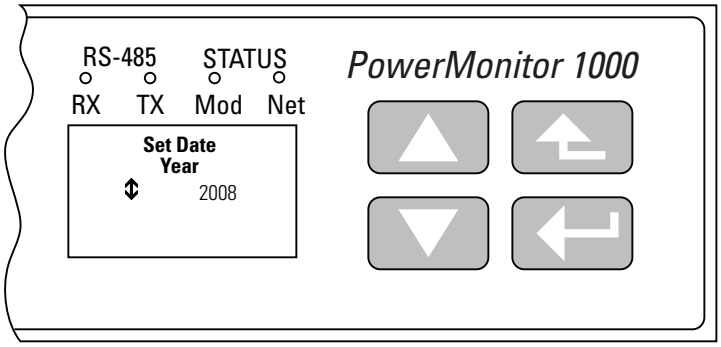
   If an incorrect password is entered, Invalid Password appears. Press any button to try again.

5. Press <enter>.

   Analog Input appears in the display. Press <down>.



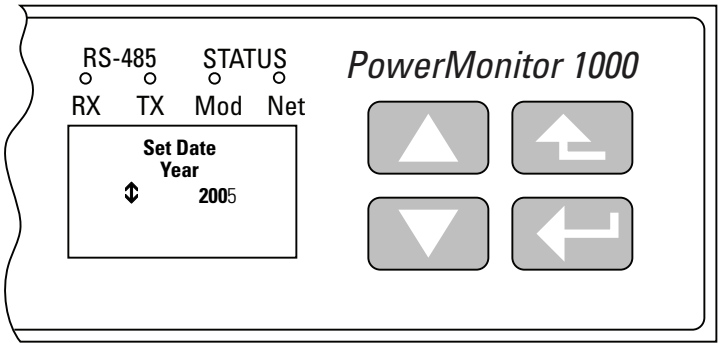
6. With Advanced Setup displayed, press <enter>, then press <down> until Set Date Year appears.



7. Press <enter> to change the value of the year.

   The power monitor is now in Edit mode, indicated by the presence of the highlight cursor. Change the year value and press <enter> to save it or <escape> to discard changes.

   See Edit a Parameter on page 19 if you need help with this.



8. Select the next item in the configuration menu by pressing <down>.

   Set the month in the same way.

Continue setting the remaining parameters in the same way.

- Navigate to the top menu display
- <enter> then <down> then <enter> to access the password screen
- Enter the correct password to access Program mode
- Navigate to the desired menu using <enter>, <up> and <down>
- <enter> selects a parameter for editing
- <up> or <down> increments or decrements the value of the highlighted digit
- <up> and <down> together move the highlight cursor
- <enter> saves your changes; <escape> discards them
- <escape> several times to the top menu to access Display mode

View Data with the Display

You may also view power monitor wiring diagnostics, metering, status and setup data using the display. To view data, select Display (instead of Setup) from the top menu and navigate through the menus as in the setup example. Press <enter> and <escape> to navigate into and out of submenus and <up> and <down> to select items within a submenu. Display mode does not permit you to change any parameter. Metering data available depends on the model of your power monitor.

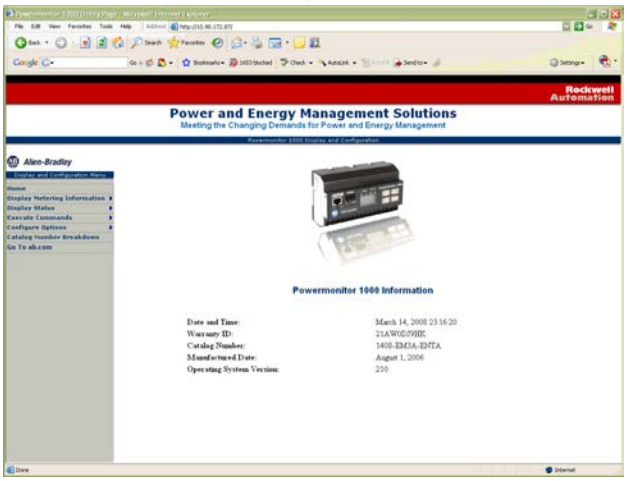
Use the Web Interface

You can use an Internet browser to view data and change configuration settings on your meter.

Follow these steps to use the Web interface.

1. Use a computer that has network access to the power monitor, open your Internet browser, type the unit IP address in the address field, and press Enter.

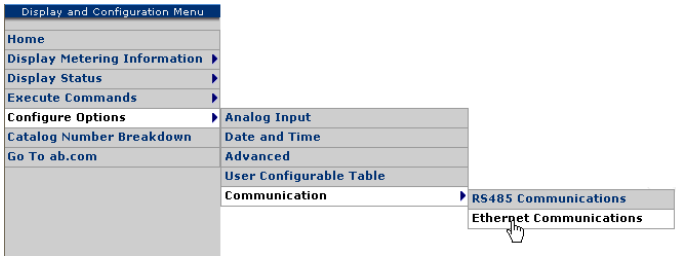
   The power monitor's home page displays in your browser.


Rockwell Automation
Power and Energy Management Solutions
Meeting the Changing Demands for Power and Energy Management
Allen-Bradley
Powermonitor 1000 Information

The home page displays general information about the power monitor. The navigation menu is on the left.

2. Click Configure Options to access the setup menus.

EXAMPLE You can change the IP address of the power monitor by navigating to the Ethernet Communication screen.



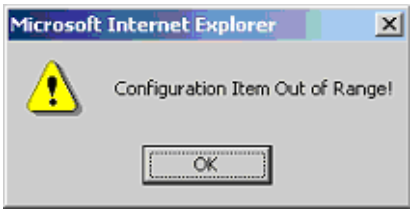
Enter the password, change the IP address, and save it by clicking Submit.

Now you can type in the new IP address in your browser and the main page refreshes using the new address.

3. Every time you change a setting or configuration you need to enter the power monitor's password (default = 0).

   If an incorrect password is entered, the following message appears.

   If the password is correct but one or more of the set-up parameter values is out of range, the following message appears.



Use Communication to Set Up

Please refer to the PowerMonitor 1000 User Manual, publication 1408-UM001, for detailed information on configuring the unit through communication with a programmable controller or custom software application.

Set-up Menus

Whichever set-up method you select, set-up parameters are organized in five set-up menus.

- Analog input setup
- Advanced setup
- RS-485 communication setup
- Optional Ethernet network communication setup
- Date and time setup

PowerMonitor 1000 Unit Features

This section describes in detail the functions of the power monitor. Each function includes information on set-up menus and parameters used to control its operation.

Analog Input Setup

This feature applies to all models.

Setup

The power monitor calculates metering results based on scaled voltage and current inputs. Setting up the analog inputs is necessary to obtain accurate, properly scaled metering results.

Parameter	Description	Range	Default	User Setting
Voltage mode	Should match the external electrical system and how it is wired to the PowerMonitor voltage and current input terminals. Refer to the wiring diagrams. 0 = Direct Delta 1 = Open Delta 2 = Wye 3 = Single Phase 4 = Demo, simulated results 5 = 1PT1CT-LL 6 = 1PT1CT-LN	0…4	2	
PT primary	The primary value of the PT ratio (Pri:Sec) indicating the nominal voltage present at the high-end of the transformer. For direct connect, set the PT ratio to any valid 1:1 ratio (for example, 480:480).	1.00… 50,000	480	
PT secondary	The secondary value of the PT ratio (Pri:Sec) indicating the nominal voltage present at the low-end of the transformer.	1…600	480	
CT primary	The primary value of the CT ratio (Pri:5) indicating the nominal current present at the high-end of the transformer. The nominal CT rated current is 5 A.	5…50,000	5	
System PF setting	Select range corresponding to expected power factor.	0 = Lead (-97…89) 1 = High (-85…98) 2 = Low (-52…-95)	2 = Low	

Related Functions

- Wiring diagnostics
- Configuration lock

Wiring Diagnostics

The power monitor performs wiring diagnostics on command to detect and report wiring errors. Wiring diagnostics operate in any wiring mode except Demo and 1PT 1CT modes, provided that measured current is at least 10% of the CT primary parameter in Analog Setup. You may select from three ranges of system power factor to improve wiring diagnostics accuracy.

This function applies to all models. Models 1408-EM1 and 1408-EM2 provide a limited results set.

Diagnostic Parameters

When a Perform wiring diagnostics command is given, the power monitor calculates and returns the results. To reduce the likelihood of erroneous or misleading wiring diagnostic data, interim results of multiple tests must agree before results are displayed. Wiring diagnostic results return to their default status approximately five minutes after the command is issued.

Wiring status:

- Pass - system wiring is correct for the voltage mode and power factor selections.
- Failed - system wiring is incorrect. Refer to voltage and current input status for additional information.
- Input Low - measured current is below 10% of full scale.
- Disabled - the power monitor is in Demo or 1PT 1CT wiring mode.
- Waiting Command - five minutes have elapsed since the most recent command.
- Out of Range - measured phase angles are outside the range of the selected system power factor.
- Voltage or current input missing (input below the metering threshold) or inverted (reverse polarity, 180 degrees out of phase)
  - -1 — Test not run; see wiring status for reason.
  - 0 — Pass, all inputs present / correct polarity.
  - 1 — Phase 1 missing / inverted.
  - 2 — Phase 2 missing / inverted.
  - 3 — Phase 3 missing / inverted.
  - 12 — Phase 1 and 2 missing / inverted.
  - 13 — Phase 1 and 3 missing / inverted.
  - 23 — Phase 2 and 3 missing / inverted.
  - 123 — All 3 phases missing / inverted.
- Voltage rotation
  - -1 — Test not run; see wiring status for reason.
  - 123 — Forward phase rotation (ABC).
  - 132 — Reverse phase rotation (ACB).
  - 4 — Invalid phase rotation (2 inputs wired with same phase).

- Current rotation, referenced to voltage Phase 1
  - -1 — Test not run; see wiring status for reason.
  - 123 — Forward rotation (ABC).
  - 231 — Forward rotation, 120 degrees displaced (BCA).
  - 312 — Forward rotation, 240 degrees displaced (CAB).
  - 132 — Reverse rotation (ACB).
  - 213 — Reverse rotation, 120 degrees displaced (BAC).
  - 321 — Reverse rotation, 240 degrees displaced (CBA).
  - 4 — Invalid phase rotation (2 inputs wired with same phase).

Forward phase rotation is not required to pass wiring diagnostics. Before changing wiring connections, refer to both the voltage / current rotation and voltage/current inverted status to select the correct analog input.

Magnitude and Phase Angle

The power monitor continually returns voltage and current magnitude and phase angle data. This data may be used to construct a phasor diagram, and in addition to the diagnostics parameters, to troubleshoot wiring issues. The following exceptions apply.

- Magnitude data is not returned by models 1408-EM1 and -EM2
- Current phase angle 2 always returns 0 in open-delta wiring mode

TIP The Troubleshooting mode of the power monitor lets you view magnitude data.

Please refer to Troubleshooting Mode on page 28.

Phase angles are consistent with the four-quadrant power metering diagram.

Refer to Power Metering on page 34.

Setup

Basic analog setup is required. In addition, a system power factor should be selected. The ranges are as follows:

- Low (52...95% lag, default setting)
- High (85 lag ...98% lead)
- Leading (97 lag ...89% lead)

Results

Wiring diagnostics results may be viewed using the following methods:

- Web interface
- LCD screen
- Communication
- HyperTerminal communication tool

Commands

- Perform wiring diagnostics
- Test wiring connections (LCD screen menu)

Troubleshooting Mode

Troubleshooting mode lets you enter a password-protected command that makes available all metered parameters for troubleshooting purposes. Troubleshooting mode does not change the data log support.

TIP This mode does not apply to the 1408-EM3 because this meter already has all of the parameters available.

RS-485 Communication

This function applies to all models.

Setup

Your power monitor is set up to communicate via its RS-485 port using a default set of parameters when you first apply power.

Parameter	Description	Range	Default	User Setting
Protocol Setting		DF1 Half-duplex Slave DF1 Full-duplex Modbus RTU Slave Auto Sense DH485	DF1 Full-duplex	
Delay(1)	Time between receiving a request and transmitting a response	0…75 ms	10 ms	
Baud Rate	Communication bit rate per second	1200, 2400, 4800, 9600(2), 19.2k(2), 38.4k, 57.6k	38.4k	
RS-485 Address	Uniquely identifies the power monitor on a multi-drop network	1…247 0…31(3)	Unit ID number	
Data Format	Data bits / stop bits / parity	8 / 1 / none 8 / 1 / even(3) 8 / 1 / odd	8 / 1 / none	
Inter Character Timeout(1)	Minimum delay between characters that indicates the end of a Modbus message packet	0…6553 ms	0 = 3.5 character times	
Max Node Address(3)		1…31	31	

(1) Delay, Inter Character Timeout parameters have no effect on DH485 protocol

(2) The baud-rate setting for DH485 should be 9600 or 19.2 k

(3) DH485

DH-485 protocol is supported in firmware FRN 2.0 and higher. If DH-485 is selected, the data format is automatically set to 8 / 1 / even. Recommended data rates for DH-485 are 9600 and 19.2k.

Error checking method is Cyclic Redundancy Check (CRC). All devices on a multi-drop RS-485 network must be set at the same data rate and each must be assigned a unique network address.

Optional Ethernet Network Communication

The power monitor supports simultaneous operation of the optional Ethernet network and serial ports.

This feature applies to all models with catalog numbers ending in -ENT.

The Ethernet network port supports 10 or 100 Mbps data rate, half-duplex, or full-duplex.

Setup

The Ethernet network port is set up with a default IP address and gateway using a common auto-configuration addressing scheme. The default address simplifies the task of making an initial connection to the unit from a personal computer with a compatible Class B IP address.

Parameter	Description	Range	Default	User Setting
IP address bytes 1…4	Unit IP address in format aaa.bbb.ccc.ddd	0…255	192.168.254.x (x is the unit's ID)	
Subnet mask bytes 1…4	Subnet mask in format aaa.bbb.ccc.ddd	0…255	255.255.0.0	
Gateway IP address bytes 1…4	Gateway IP address in format aaa.bbb.ccc.ddd	0…255	128.1.1.1	
SNTP setup	See Date and Time Functions setup. Includes: SNTP mode Update interval Time zone Time server IP address			

The power monitor operates with a fixed IP address that uniquely identifies it on the network. An IP address of 255.255.255.255 is not permitted. The power monitor does not support BOOTP or DHCP auto-addressing.

IMPORTANT	The IP address for your power monitor must not conflict with the IP address of any other device on the network. Contact your network administrator to obtain a unique IP address, subnet mask, and default gateway address for your unit.

Ethernet Network Addressing

The IP address is a 32-bit binary number, which consists of the network address (NetID) and the machine address (HostID). The Subnet mask defines the boundary between the NetID and HostID and each 0 represents the HostID.

Table 1 - Ethernet Network Addressing Example

IP address	(decimal):	192	1	1	207
	(binary):	11000000	00000001	00000001	11001111
Subnet mask	(decimal):	255	255	255	0
	(binary):	11111111	11111111	11111111	00000000
		----	Net ID	----	-Host ID-

In this example, the NetID is 192.1.1.0 and the HostID is 0.0.0.207. The relationship between NetID and HostID depends on the IP address class, the discussion of which is beyond the scope of this document (the example uses a Class C IP address). Devices on the same subnet can communicate directly; devices on different subnets may communicate with each other only through a gateway or router.

The Gateway IP address defines the address of the gateway or router on the unit's subnet that is used to route messages to other subnets for wide-area networking. The default is 128.1.1.1.

Energy Metering

This function applies to catalog numbers 1408-EM1, 1408-EM2, and 1408-EM3.

Metered Parameters

The power monitor calculates and returns the totalized energy values including the following:

- GWh forward, GWh reverse, and GWh net
- kWh forward, kWh reverse, and kWh net
- GVARh forward, GVARh reverse, and GVARh net
- kVARh forward, kVARh reverse, and kVARh net
- GVAh and kVAh

Each time the kWh value rolls over to zero the GWh value increments by one. The other pairs of values operate in the same way.

EXAMPLE A large energy value could be displayed as 123,456,789,234.567 kWh where 123,456 is the GWh metering result and 789,234.567 is the kWh metering result.

Energy results (kWh, kVARh, and kVAh) roll over to 0 at a value of 9,999,999,999,999 or 10^{12}-1.

Setup

Only basic analog input setup is required for energy metering.

Results

Energy metering results may be viewed using the following methods:

- Web interface
- LCD screen
- Communication

Energy results are not available via the HyperTerminal communication tool.

Commands

The following commands are supported by the power monitor:

- Set GWh/kWh register
- Set GVARh/kVARh register
- Set GVAh/kVAh register
- Clear all energy registers

Related Functions

- KYZ output
- Energy log
- Configuration lock

Demand Metering

Demand is an electric power term that expresses the average energy usage over a period of time. The power monitor may be configured to measure demand using a fixed demand period or a sliding window. The demand period may be timed internally, synchronized to an external demand end-of-interval contact connected to the S2 status input, or synchronized using communication.

This function applies to catalog numbers 1408-EM2 and 1408-EM3.

Metered Parameters

The power monitor calculates and returns the following demand values:

- Real power demand, kW
- Reactive power demand, kVAR
- Apparent power demand, kVA
- Demand power factor, percent lagging (-) or leading (+)
- Projected kW, kVAR, and kVA demand
- Demand interval elapsed time, minutes

Projected demand calculates a linear projection of demand at the end of a demand interval.

Demand power factor is calculated using the following formula.

kW Demand / kVA Demand

Setup

Demand metering requires basic analog input setup as well as demand calculation setup. Basic demand set-up parameters are found in the Advanced Setup menu. Network demand synchronization is available on units connected to an Ethernet network. Network-demand synchronization set-up parameters are found in the Ethernet communication set-up menu.

Parameter	Description	Range	Default	User Setting
Demand Source (advanced setup)	Selects the source of the demand end-of-interval (EOI) signal. 0 = Internal Timer 1 = Status Input 2 2 = Controller Command 3 = Ethernet Demand Broadcast Network-demand synch options are available only on units with an optional Ethernet network installed. • If Demand Broadcast Master Select is set to master then a Demand Source value of 0…2 selects the EOI source that is used to trigger the demand-synch master broadcast. • If Demand Broadcast Master Select is set to slave then a Demand Source value of 0…3 selects the EOI source.	0…3	0	
Demand Period Length (advanced setup)	Specifies the period for demand calculations. The following include special cases. Demand source = 0 (internal time) and demand period length = 0 then demand metering is disabled Demand source 0 and demand period length = 0 then projected demand is disabled Demand source 0 and demand period length 0 then projected demand is calculated using the unit's internal clock	0…99 min	15 min	
Number of Demand Periods (advanced setup)	Specifies the number of demand periods to average together for demand measurement. This parameter is used for sliding window demand calculations. For example, for a 30 minute sliding-window, demand period length = 2 minutes and number of demand periods = 15.	1…15	1	

Parameter	Description	Range	Default	User Setting
Forced Demand Sync Delay (advanced setup)	If demand source 0 and demand period length 0 then this parameter determines how long the unit waits for an EOI pulse, command, or broadcast after the expected control pulse has not been received. If the EOI signal is not received before the waiting period expires, a new demand period starts and a record is entered in the status log. Special case: 0 = Wait forever	0…900 s	10	
Demand Broadcast Master Select (Ethernet setup)	0 = Slave, the unit uses its selected demand source to calculate demand. If demand source = 3 (Ethernet demand broadcast) the unit will listen to the selected-broadcast port number for a broadcast from the demand-sync master unit. 1 = Master, the unit broadcasts an EOI broadcast to the selected-UDP port number when the selected demand source detects an EOI event.	0…1	0	
Broadcast Port Number (Ethernet setup)	Specifies the listening or broadcast port for the UDP Ethernet-demand broadcast message.	300…400	300	

Results

Demand metering results may be viewed using the following methods:

- Web interface
- LCD display
- Communication

Demand results are not available via the HyperTerminal communication tool.

Commands

- Controller command (EOI signal)

Related Functions

- Status inputs
- Time of use log
- Configuration lock

Power Metering

This function applies to catalog numbers 1408-TR1 (power factor only), 1408-TR2, and 1408-EM3.

Metered Parameters

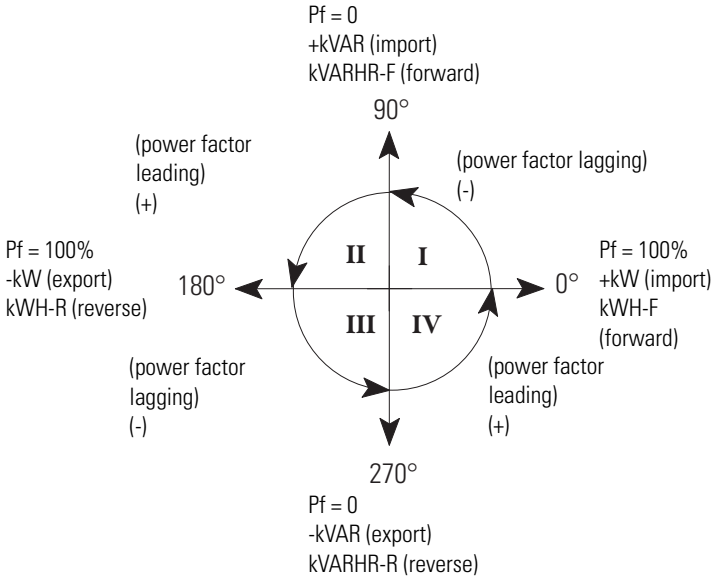
The power monitor calculates and returns four-quadrant power measurements including these:

- L1, L2, L3 and Total True Power Factor, percent lagging (-) and leading (+)
- L1, L2, L3 and Total Real Power, kW
- L1, L2, L3 and Total Reactive Power, kVAR
- L1, L2, L3 and Total Apparent Power, kVA

Only total three-phase power results are provided when Direct Delta or Open Delta wiring modes are selected.

The Magnitude and Direction of Power Quantities chart indicates the relationship between the magnitude and direction of the power quantities and the numeric signs used by the power monitor.

Figure 6 - Magnitude and Direction of Power Quantities



Setup

Only basic analog-input setup is required for power metering.

Results

Power metering results may be viewed using the following methods:

- Web interface
- LCD screen
- Communication
- HyperTerminal communication tool

Related Functions

- Metering result averaging
- Configuration lock

Voltage, Current, and Frequency Metering

This function applies to catalog numbers 1408-TR1, 1408-TR2, and 1408-EM3.

Metered Parameters

The power monitor calculates and returns voltage, current, and frequency measurements including these:

- L1, L2, L3, and Average Current, A
- L1-N, L2-N, L3-N, and Average L-N Voltage, V
- L1-L2, L2-L3, L3-L1, and Average L-L Voltage, V
- Frequency
- Percent Current Unbalance
- Percent Voltage Unbalance

Line-to-neutral voltage results are not provided for Delta and Open Delta wiring modes.

Voltage and current unbalance are calculated according to the following formula.

$$\frac{\text{Maximum Deviation from Average} \times 100}{\text{Average}}$$

Setup

Only basic analog-input setup is required for power metering.

Results

Voltage, current, and frequency metering results may be viewed using the following methods:

- Web interface
- LCD screen
- Communication
- HyperTerminal communication tool

Related Functions

- Metering result averaging
- Configuration lock

Date and Time Functions

The power monitor internal clock and calendar is used in demand metering and data logging functions. A number of user-selectable options are available for synchronizing and controlling the internal clock and calendar.

This function applies to all models.

Date and Time Parameters

- Date: Year, Month, Day
- Time: Hour, Minute, Seconds, Hundredths

Basic Setup

Basic setup is done using the date and time setup menu.

TIP In the LCD screen, date and time are included in the Advanced Setup menu.

Parameter	Range	Default
Date: Year	2001…2100	2005
Date: Month	1…12	1
Date: Day	1…31	1
Time: Hour	0…23	0
Time: Minute	0…59	0
Time: Seconds	0…59	0
Time: Hundredths	0…99	0

Daylight-savings Time Setup

Daylight-savings time (DST) setup is done in the Advanced Setup menu. If DST is enabled, the power monitor internal clock advances by one hour on the start date and hour specified, and is set back by one hour on the return date and hour specified. The defaults represent the common DST start and return date/times in use in the United States in 2006. The DST function also adjusts the network-time synch offset when used.

Parameter	Description	Range	Default	User Setting
Use DST Correction	0 = Disables DST 1 = Enables DST	0…1	0	
DST Month/ Week/Day Start	Format: MMWWDD Month: 01 = January…12 = December Week: 01 = 1st week…05 = Last Week Day of Week: 01 = Sunday…07 = Saturday	010101… 120507	030201 March, 2nd, Sunday	
Hour of Day Start		0…23	2 (2 am)	
Return from DST Month/ Week/Day	Format same as start date	010101… 120507	110101 November, First, Sunday	
Hour of Day End		0…23	2 (2 am)	

Network Time Synchronization

Network time synchronization is available only on units equipped with the optional Ethernet network. Set-up parameters are found in the Ethernet communication set-up menu. The power monitor updates its time from a simple network time protocol (SNTP) server or an anycast group of SNTP servers, depending on setup parameter values. Network-time synchronization set-up parameters are found in the Ethernet communication set-up menu.

Parameter	Description	Range	Default	User Setting
SNTP Mode Select	0 = Disable 1 = Unicast – Specify the IP address of a unicast SNTP server. 2 = Anycast mode – Specify the broadcast IP address of a SNTP anycast group.	0…2	0	
SNTP Update Interval	Defines how often the time is updated from the SNTP server.	1…32766 minutes	300	
Time Zone Select	There are 32 available time zones.	0…32	7 (Eastern Time)	
Time Server IP Address	Unicast server or anycast group IP address in format aaa.bbb.ccc.ddd.	0.0.0.0… 255.255.255.255	0.0.0.0	

Related Functions

- Demand metering
- Data logging

Energy Log

The energy log is one of five data logs where the power monitor records metering and status data. Data logging setup is performed using optional RSPower or RSEnergyMetrix RT software via communication.

Refer to RSPower Getting Results Guide, publication RSPWR-GR002 and RSEnergyMetrix Getting results guide, publication ENEMTX-GR001 for information on the software.

For details on the communication interface for data logging setup and record access, refer to the PowerMonitor 1000 Communication Reference Manual, publication 1408-UM001.

This function applies to catalog numbers 1408-EM1, 1408-EM2, and 1408-EM3.

Logged Parameters

Energy log records contain a date/time stamp and the metering parameters listed below.

Metering Parameter	EM1	EM2	EM3
Status Input 1 Scaled Count	•	•	•
Status Input 2 Scaled Count	•	•	•
Real Energy Net, GWh / kWh	•	•	•
Reactive Energy Net, GVARH / kVARh		•	•
Apparent Energy Net, GVAh / kVAh		•	•
Real Power Demand, kW		•	•
Reactive Power Demand, kVAR		•	•
Apparent Power Demand, kVA		•	•
Demand PF, percent		•	•

Results

Energy log records can be accessed only via communication.

Commands

- Clear energy log

Related Functions

- Energy metering, Demand metering
- Configuration lock

Min/Max Log

The power monitor records time-stamped minimum and maximum values for all real-time metering data (except for energy data).

This feature applies to catalog numbers 1408-TR1, 1408-TR2, and 1408-EM3.

Logged Parameters

The min/max log contains a record for each of the metering parameters listed below along with a date/time stamp corresponding to the minimum and maximum value recorded.

Metering Parameter	TR1	TR2	EM3
L1, L2, L3 and Average Current	•	•	•
L1-N, L2-N, L3-N and Average L-N Voltage	•	•	•
L1-L2, L2-L3, L3-L1 and Average L-L Voltage	•	•	•
Frequency	•	•	•
Percent Current Unbalance	•	•	•
Percent Voltage Unbalance	•	•	•
L1, L2, L3 and Total True Power Factor		•	•
L1, L2, L3 and Total Real Power, kW		•	•
L1, L2, L3 and Total Reactive Power, kVAR		•	•
L1, L2, L3 and Total Apparent Power, kVA		•	•
Real Power Demand, kW			•
Reactive Power Demand, kVAR			•
Apparent Power Demand, kVA			•
Demand PF, percent			•

Results

Min/max log records can be accessed only via communication.

Commands

- Clear single min/max log record
- Clear min/max log

Related Functions

- Energy metering
- Demand metering
- Voltage, current and frequency metering
- Power metering

Load Factor Log

The power monitor maintains a 12-month record of demand and load factor. Load factor is average demand divided by peak demand and is a measure of load variability.

This function applies to catalog numbers 1408-EM2 and 1408-EM3.

Logged Parameters

The load factor log consists of 13 records, an in-process record for the current month, and one record for the previous 12 months. The monthly records operate in a circular or FIFO fashion. On a user-selected day each month, the current record is pushed into the monthly record stack and cleared. Each record contains the following data:

- Real power demand, peak and average, kW
- Real power load factor, percent
- Reactive power demand, peak and average, kVAR
- Reactive power load factor in percent
- Apparent power demand, peak and average, kVA
- Apparent power load factor in percent

Results

Load factor log records can be accessed only via communication.

Commands

- Store and clear current Load Factor Record
- Clear Load Factor Log

Related Functions

- Demand metering

Time of Use Logs

The power monitor maintains records of energy and demand organized by times of use you define. These records may be used for billing and cost allocation by RSPowerPlus software.

There are up to three time-of-use (TOU) logs, one for real energy and demand, one for reactive energy and demand, and one for apparent energy and demand. Within each log, energy consumption and peak demand are recorded into off-peak, mid-peak, and on-peak categories. The days and times that define the mid- and on-peak periods are user selectable. All times of use not defined as mid- or on-peak are considered off-peak.

This function applies to catalog numbers 1408-EM1 (one TOU log, real energy only), 1408-EM2 (three TOU logs, energy, and demand), and 1408-EM3 (three TOU logs, energy, and demand).

Logged Parameters

Each TOU log consists of 13 records, an in-process record for the current month, and one record each for the previous 12 months. The monthly records operate in a circular or FIFO fashion. On a user-selected day each month, the current record is pushed into the monthly record stack and cleared. Each record contains the following data:

- Net energy: off-peek, mid-peek, and on-peak
- Peak demand: off-peek, mid-peek, and on-peak
- Start and end date/time of the record
- Record number

Results

Time of use log records can be accessed only via communication.

Commands

- Store and clear current TOU Record
- Clear TOU Log

Related Functions

- Energy metering
- Demand metering

Status Log

The Status log records the date and time of changes made to the device and of external events. The status log consists of 50 records and operates in a circular or FIFO fashion. The status log may not be cleared.

This function applies to all models.

Logged Events

- Configuration changed
- Clock set
- Relay output forced on or off
- Status input activated or deactivated (may be disabled)
- Status input counter 1 or 2 rollover or set
- Missed external sync pulse
- Energy register rollover or set
- Device power-up or power-down
- Self-test status

Results

Status log records can be accessed only via communication.

Related Functions

- Log status input changes

I/O Functions

The I/O functions include Relay KYZ Output, Status Inputs, and Configuration Lock Input.

Relay KYZ Output

The KYZ output is a solid-state relay designed for low-power, long-life signaling operation. Its typical use is to provide a pulse output proportional to energy consumption to an external totalizer.

This function applies to catalog numbers 1408-EM1, 1408-EM2, and 1408-EM3 for energy pulse.

This function applies to all models for forced operation.

Operation

The KYZ output can operate in any of the following modes:

- Energy pulse operation with fixed pulse width or toggle
- Forced operation

Setup

KYZ-output set-up parameters are found in the Advanced Setup menu and are summarized in the table.

Parameter	Description	Range	Default	User Setting	Model				
					TR1	TR2	EM1	EM2	EM3
KYZ Output Parameter	0 = Disable 1 = Wh Fwd 2 = Wh Rev	0…2	0				•	•	•
	3 = VARh Fwd 4 = VARh Rev 5 = VAh	0…5						•	•
KYZ Output Scale	The increase in value of the selected parameter that caused the output to change state	1… 100,000	1000				•	•	•
KYZ Pulse Duration Setting	0 = toggle output 50…1000 = duration of output pulse, rounded to 10 ms	0 or 50… 1000	250 ms				•	•	•

Commands

- Force KYZ Output On
- Force KYZ Output Off
- Remove Force from KYZ

Related Functions

- Configuration lock

Status Inputs

The power monitor has two self-powered (24V DC) status inputs. Two typical uses for status inputs are to totalize external pulse meters and to synchronize the demand end of interval (EOI).

This function applies to catalog numbers 1408-EM1 (except demand EOI synch), 1408-EM2, and 1408-EM3.

Operation

Each time status input 1 sees an off-to-on transition, the status input 1 scale factor is added to the status input 1 count. The count continues to increase, rolling over to zero at a value of 9,999,999,999,999 ($10^{12} - 1$). Status input 2 operates in the same fashion. Status input 2 counter operates whether or not the input is used for demand EOI synchronization.

Setup

The set-up parameters for pulse totalizing and scaling are in the Advanced Setup menu and are summarized in this table.

Parameter	Description	Range	Default	User Setting	Model				
					TR1	TR2	EM1	EM2	EM3
Status Input 1 Input Scale	When a status input sees an off to on transition, the status input count is increased by the scale factor.	1… 1,000,000	1				•	•	•
Status Input 2 Input Scale		1… 1,000,000	1				•	•	•

Setup for demand EOI synchronization is described in the Demand Metering section.

Metering Parameters

- Status 1 Count x1,000,000 and x1
- Status 2 Count x1,000,000 and x1

Commands

The following commands may be used to preset or reset the status input counters:

- Set Status 1 Count
- Set Status 2 Count

Related Functions

- Log status input changes
- Configuration lock

Configuration Lock Input

Unauthorized changes to the power monitor setup are prevented when the configuration-lock input terminals, CF and CF1, are connected together.

This feature applies to all models.

Operation

The following set-up parameters and commands are locked when the configuration lock is applied:

- Analog input setup menu: all parameters
- Advanced setup menu
- Metering result averaging
- Log status input changes
- KYZ setup
- Status input 1 and 2 input scale
- Demand setup
- Ethernet communication set-up menu
- Network demand setup

The following commands are prohibited when the configuration lock is applied:

- Set kWh, kVARh, kVAh register
- Clear all energy registers
- Set status 1 or 2 count
- Clear energy log
- Force KYZ output on, off, or clear force
- Restore factory defaults
- Reset power monitor system

Setup

No setup is needed.

Miscellaneous Functions

The power monitor includes a small number of miscellaneous functions that you can select. Set-up parameters of these functions are in the Advanced Configuration set-up menu.

Parameter	Description	Range	Default	User Setting
New Password	Select a new password if desired to help prevent unauthorized changes to the unit setup.	0…9999	0	
Metering Result Averaging	If enabled, metering results are averaged by using the previous eight cycles to smooth the results.	0 = Off 1 = On	1	
Log Status Input Changes[1]	If disabled, prevents routine status input changes from filling up the status log. Useful when a status input is used for pulse counting or demand EOI synch.	0 = Disable 1 = Enable	0	
Unit Error Action	Determines the unit's response to a hardware or firmware error. 0 = Halt, make status indicator solid red 1 = Reset the unit	0…1	1	
Software Error Log Full Action	Determines the unit response when a firmware failure is detected and the error log is full. 0 = Halt on error and wait for clear log command, make status indicator solid red 1 = Perform a firmware reset	0…1	1	

(1) Log status input changes parameter is not accessible from the LCD screen.

Commands

The power monitor offers the following commands. The power monitor Commands table can be accessed using the LCD screen, the HyperTerminal communication tool, the Web interface, or via communication.

Commands that do not apply to the power monitor model are ignored.

Command	Parameters	Action
Set kWh register	GWh / kWh forward GWh / kWh reverse	Presets forward and reverse energy values, resets if parameters = 0
Set kVARh register	GVARh / kVARh forward GVARh / kVARh reverse	
Set kVAh register	GVAh / kVAh forward GVAh / kVAh reverse	
Clear all energy registers	-	Resets all energy values
Set Status 1 count	New status 1 count	Presets or resets status input count
Set Status 2 count	New status 2 count	
Clear energy log	-	Clears all data from energy log
Force KYZ output on	-	Forces the KYZ output state, over-rides automatic action
Force KYZ output off	-	
Remove force from KYZ	-	Restores automatic action of KYZ output as configured
Restore factory defaults	-	Clears all user-configured values from the setup menus to their factory default settings

Command	Parameters	Action
Reset system	-	Warm reboot: Performs a power-on self test of the power monitor
Test wiring connections	-	Perform wiring diagnostics
Clear min/max records	Min/max record number	Clears selected min/max record or all records if parameter = 0
Store and clear current load factor record	-	Simulates end-of-month push of in-process current month into the monthly load factor record stack
Clear load factor log		Clears all load factor log records
Store and clear current TOU record		Simulates end-of-month push of in-process current month into the monthly TOU record stack
Clear TOU log		Clears all TOU log records
Clear error log		Clears the error log

Related Functions

- Configuration lock

PowerMonitor 1000 Memory Organization

The power monitor memory is organized similarly to that of a PLC-5 or SLC 500 programmable controller. Data tables organize individual data items of similar function. For example, the analog input set-up parameters are grouped in one data table, and voltage, current, and frequency metering results in another.

Appendix A provides a detailed list of the power monitor data tables.

Data Table Addressing

Data tables may be addressed in several ways.

- CSP addressing. This is also known as PLC-5 style or PCCC addressing. Addresses are written in the form Axx:yy where A is a letter describing the function of the data table, xx is the table number, and yy is the element within, or offset into, the table. For example, F23:0 is the CSP address of the first element in the energy metering results table.
- CIP addressing. This is also known as DeviceNet addressing. Addresses are of the form Object:Instance:Attribute. CIP addressing allows addressing only a single element of an entire data table. In CIP addressing, the energy metering results table object 4 (Assembly object), instance 16 (energy results table) and attribute 3 (data).
- Modbus RTU addressing. The data tables may be addressed by a Modbus RTU master using Modbus register addressing. The Modbus protocol supports four types of data: Discrete Input, Coil, Input Register, and Holding Register. The power monitor supports Input Registers (read-only) with addresses in the 30000 range and Holding Registers (read-write or write only) with addresses in the 40000 range. Using the same example as above, the energy results table has a Modbus address range of 30401...30438

Data Table Access

Controllers and client applications may read or write single element, multiple elements or complete tables as permitted by the addressing selected.

Each data table's read/write access is listed in Appendix A.

The power monitor requires a valid password before it accepts a write. There are two ways a password may be written.

- An entire table including a valid password may be written.
- A valid password may be written to the Single element password write table which then enables single element writes until 30 minutes without a single element write elapses.

Data Table Data Format

The power monitor stores data in two basic formats.

- Integer, in which the 16-bit word may be represented by a signed integer value or a bit field
- Floating-point, in the 32-bit IEEE 754 format

Modbus input registers and holding registers are 16 bits long. Floating point values in the data tables are represented as big-Endian two-register arrays in IEEE-754 floating point format. The Modbus client application must be able to reassemble the two-word array into a valid floating-point value.

An example Modbus address for a floating-point value is 40101-2. Register 40101 holds the most significant bytes of the number and 40102 holds the lowest significant bytes.

Communications Command Summary

Serial DF1 Full-duplex, DF1 Half-duplex Slave, DH485

- PCCC Protected Logical Read w/ 2 Address Fields (CMD = 0x0F, FUNC = 0xA1)
- PCCC Protected Logical Write w/ 2 Address Fields (CMD = 0x0F, FUNC = 0xA9)
- PCCC Protected Logical Read w/ 3 Address Fields (CMD = 0x0F, FUNC = 0xA2)
- PCCC Protected Logical Write w/ 3 Address Fields (CMD = 0x0F, FUNC = 0xAA)
- PCCC Protected Logical Write w/ 4 Address Fields (CMD = 0x0F, FUNC = 0xAB)
- PCCC Status Diagnostics (CMD = 0x06, FUNC = 0x03)

Optional EtherNet/IP

- CIP Generic Assembly Object (Class 04), Get & Set Attribute Single for Attribute 3 (data)
- CIP Generic Assembly Object (Class 04), Get Attribute Single for Attribute 4 (size)
- PCCC PLC5 Word Range Write Function (CMD = 0x0F, FUNC = 0x00)
- PCCC PLC5 Word Range Read Function (CMD = 0x0F, FUNC = 0x01)
- PCCC PLC5 Typed Write Function (CMD = 0x0F, FUNC = 0x67)
- PCCC PLC5 Typed Read Function (CMD = 0x0F, FUNC = 0x68)
- PCCC Protected Logical Read Function w/2 Address Fields (CMD = 0x0F, FUNC = 0xA1)
- PCCC Protected Logical Write Function w/2 Address Fields (CMD = 0x0F, FUNC = 0xA9)
- PCCC Protected Logical Read Function w/3 Address Fields (CMD = 0x0F, FUNC = 0xA2)
- PCCC Protected Logical Write Function w/3 Address Fields (CMD = 0x0F, FUNC = 0xAA)
- PCCC Status Diagnostics (CMD = 0x06, FUNC = 0x03)

Modbus RTU Serial and Optional Modbus/TCP Ethernet

The power monitor does not initiate Modbus commands but responds to commands sent by the Modbus master. These Modbus function codes are supported.

- 03 Read Holding Registers
- 04 Read Input Registers
- 16 Write Multiple Holding Registers
- 08 Diagnostics
  - 00 Echo Command Data
  - 02 Return Diagnostic Counters
  - 10 Clear Diagnostic Counters
- 06 Write Single Holding Register

Explicit Messaging

This section discusses data retrieval and parameter configuration using explicit messaging from Rockwell Automation controllers. Explicit messaging allows you to read and write from a controller to specific data tables within the power monitor. With explicit messages, users can read real-time power and energy values, configure analog input parameters, configure communication parameters, and also read energy logs.

In general, these instructions apply to Ethernet network communication (Ethernet/IP protocol) and Serial communication (DF1 half-duplex or full-duplex or DH485 protocols), provided that the protocol is supported by the controller. If using serial communication, the controller serial port must be correctly configured for protocol, communication rate, or parity. Refer to the appropriate controller user documentation for further details.

Please refer to Appendix A, PowerMonitor 1000 Data Tables for descriptions of the power monitor data tables and their data access privileges, and data types.

The power monitor allows PLC-5 Typed, SLC Typed, and CIP Generic message requests.

Explicit Message Setup – Examples

This section gives examples on how to set up explicit messaging.

Read/Write Single or Multiple Elements

You can perform single or multiple element reads and writes to the power monitor. Below is a table documenting the message type to use for specific read/write type and communication scenarios.

IMPORTANT	When performing a write to the power monitor, you must write the password value to the password element of that specific data table that you are writing to. This must be done in the same message; therefore you must perform a multiple element write. If you wish to perform only a single element write, you must write the password value to the Single Element Password Write table. This allows you to perform writes to any write access data table for the next 30 minutes.

Table 2 - Message Type

Read/Write Type	Communication	Read/Write Message Type
Single Element	Serial	SLC Typed
Single Element	Ethernet	PLC5 Typed or SLC Typed
Multiple Element	Serial	SLC Typed
Multiple Element	Ethernet	PLC5 Typed or SLC Typed or CIP Generic(1)

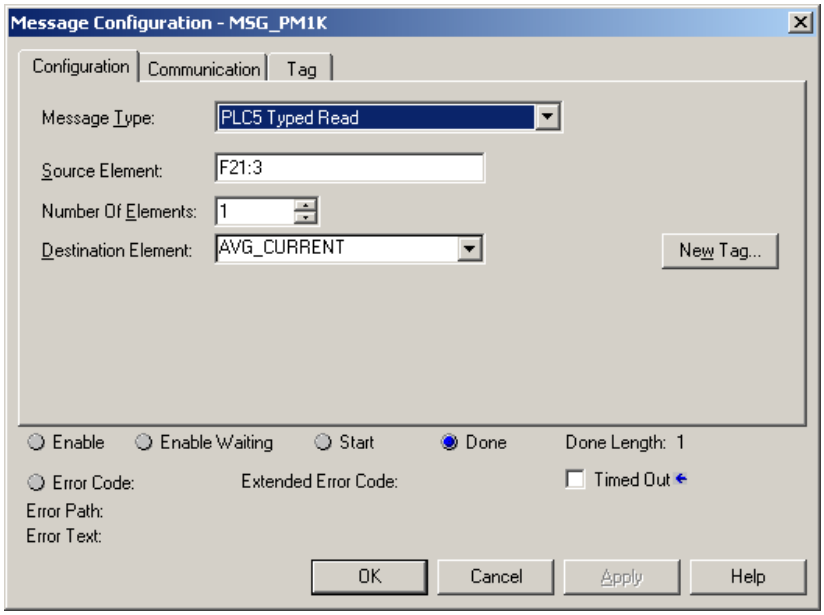
(1) The CIP Generic message type is only available for RSLogix5000 software. All elements in the data table are written to or read back.

RSLogix5000 – Message Configuration Using PLC5 or SLC Typed Read/Write

This is an example of how to set up a message instruction to read or write single or multiple elements from a power monitor using PLC5 or SLC Typed messages. This setup applies to ControlLogix and CompactLogix programmable logic controllers.

Follow these steps to configure a message.

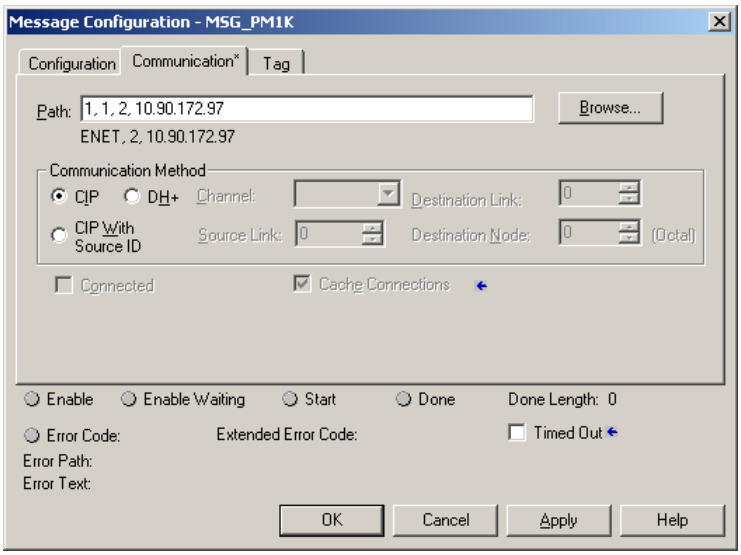
1. Choose the appropriate parameters in the Message Configuration window.



Parameter	Choice
Message type	Select the appropriate message type according to Message Type on page 54.
Source Element	Read: Refer to Appendix A – PowerMonitor 1000 Data Tables for the address of the specific data table address you're reading. If you are performing a multiple element read, this should be the first element in the array of elements you're reading back.
	Write: This is the controller tag in which to store the data being written to the power monitor.
Number of Elements	This is the number of elements being read or written to. If you are performing a single element read or write, then this value should be 1. If you are performing a multiple element read or write, then this should be the number of elements after the source element that you wish to read or write.
Destination Element	Read: This is the controller tag in which to store the data being read.
	Write: Refer to Appendix A – PowerMonitor 1000 Data Tables for the address of the specific data table address you're writing to.

2. Click the Communication tab to select the communication type, either Ethernet or Serial.

3. Choose the communication type and then set the path and communication method.



Communication Type	Path	Method
Ethernet	<Backplane (always 1), Slot of Ethernet Module, Port (always 2 for Ethernet), power monitor IP Address>	CIP
Serial communication	<Port, Power Monitor Serial Node Address>	CIP

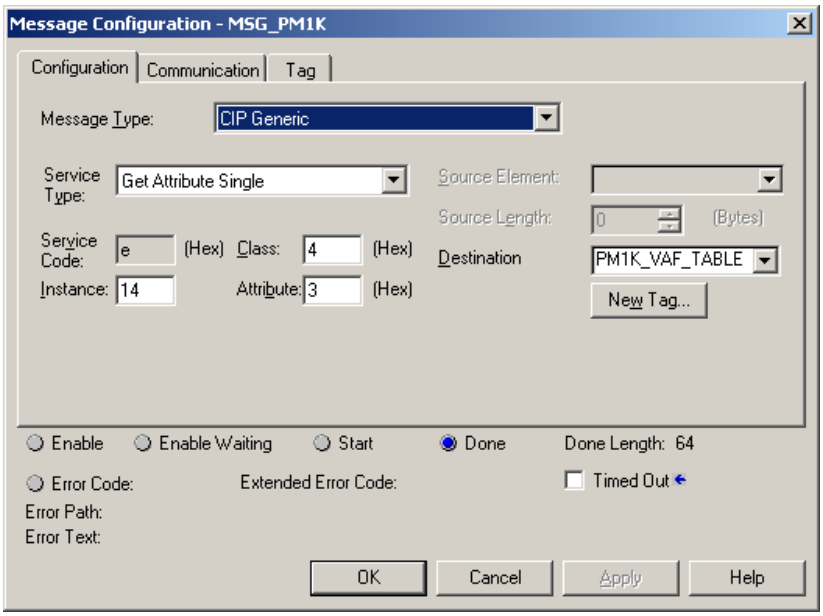
4. Click OK to complete the message setup.

RSLogix5000 Software – Message Setup Using CIP Generic

The following example shows how to set up your message instruction to read or write to a data table in the power monitor using a CIP Generic message type for RSLogix5000 software. This setup applies to ControlLogix and CompactLogix programmable logic controllers. The CIP Generic message type does not support single element reads or writes. In this example, we are reading the Voltage, Amps, and Frequency data table from the power monitor.

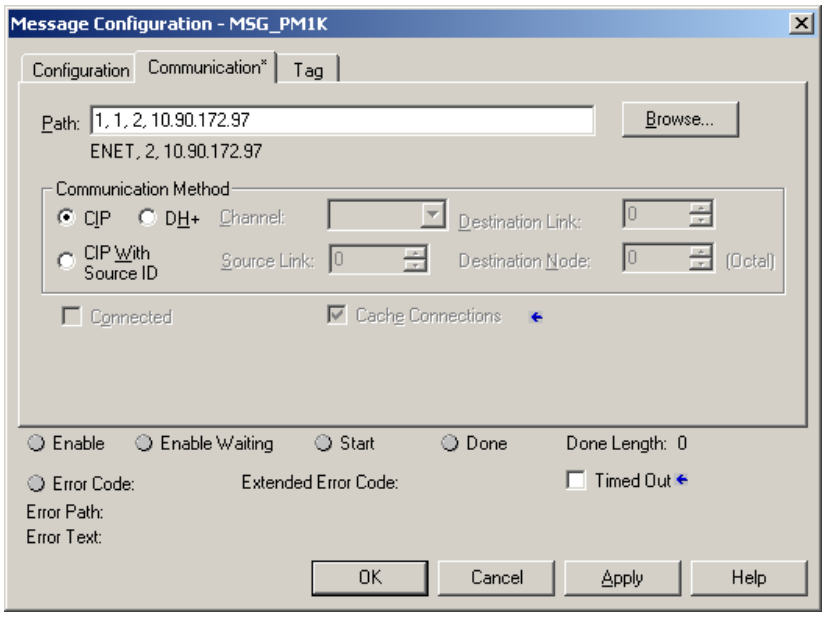
Follow these steps to configure a message.

1. Choose the appropriate parameters in the Message Configuration window.



Parameter	Choice
Message Type	Choose message type CIP Generic.
Service Type	Read: Select service type Get Attribute Single
	Write: Select service type Set Attribute Single
Instance	Refer to Appendix A for the CIP Instance of the data table you are requesting to read. In this example, the power monitor's Voltage, Amp, and Frequency data table is instance 14.
Class	4
Attribute	3
Destination	Get Attribute Single - This is the controller tag in which to store the data being read.
Source Element	Set Attribute Single - Refer to Appendix A for the address of the specific data table address you're writing to.
Source Length	Set Attribute Single - This is the number of elements of the source element, to be written to the power monitor.

2. Click the Communication tab and enter the path and method.



Path	Method
<Backplane (always 1), Slot of Ethernet Module, Port (always 2 for Ethernet), Power Monitor IP Address>	CIP

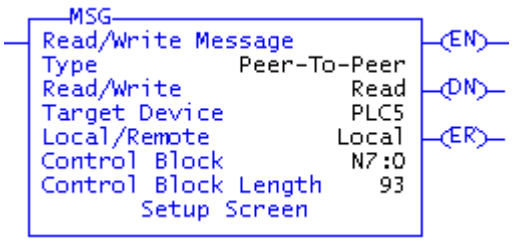
3. Click OK to complete message setup.

RSLogix500 Software - Message Setup Using PLC5 or SLC Typed Read/Write

The following is an example of how to set up your message instruction to read or write single or multiple elements to a power monitor using Peer-To-Peer PLC5 or CPU 500 Typed messages in RSLogix500 software. This setup applies to SLC and MicroLogix programmable logic controllers.

Follow these steps to configure a message.

1. Set your MSG instruction.



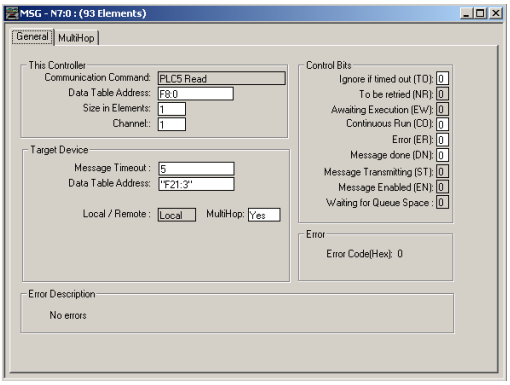
Parameter	Choice
Read/Write	Select Read or Write
Target Device	Select the appropriate message type according to Message Type on page 54.
Local/Remote	Select Local
Control Block	Select an available Integer word. In this example, we used N7:0.

2. Click Setup Screen at the bottom of the message instruction.

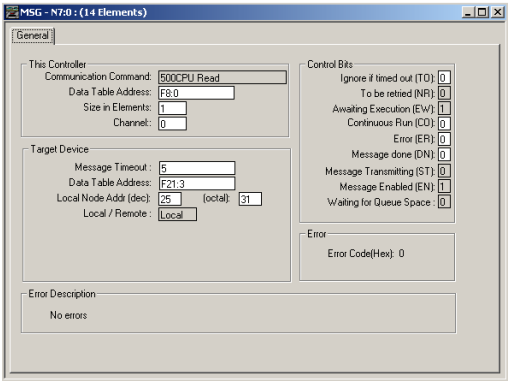
   The message configuration window for either Ethernet network or Serial communication appears.

3. Choose the appropriate parameters in the Message Configuration window.

Ethernet Network Communication



Serial Communication

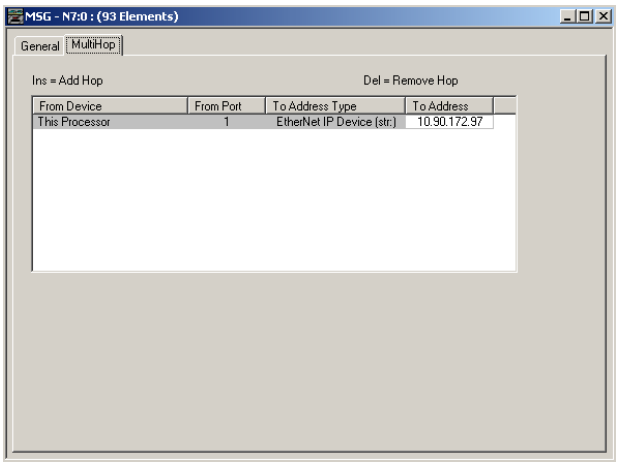


Communication Type	Parameter	Choice
Ethernet	Data Table Address (This Controller)	Read: This is the controller tag in which to store the data being read
		Write: This is the controller tag that stores the value to be written to the power monitor.
	Size in Elements	This is the number of elements being read or written to. If you are performing a single element read or write, then this value should be 1. If you are performing a multiple element read or write, then this should be the number of elements after the source element that you wish to read or write.
	Channel	1
	Data Table Address (Target Device)	Refer to Appendix A for the address of the specific data value you're reading or writing to.
	MultiHop	Yes

Communication Type	Parameter	Choice
Serial	Data Table Address (This Controller)	Read: This is the controller tag in which to store the data being read
		Write: This is the controller tag that stores the value to be written to the power monitor.
	Size in Elements	This is the number of elements being read or written to. If you are performing a single element read or write, then this value should be 1. If you are performing a multiple element read or write, then this should be the number of elements after the source element that you wish to read or write.
	Channel	0
	Data Table Address (Target Device)	Refer to Appendix A for the address of the specific data value you're reading or writing to.
	Local Node	This is the serial node address of your power monitor.

Message setup is complete for Serial communication.

4. Click the MultiHop tab if configuring Ethernet communication.
5. Enter the IP Address of the power monitor in the To Address box.



Message setup is complete.

RSLogix5 Software - Message Setup Using PLC5 or SLC Typed Read/Write

The following is an example of how to set up your message instruction to read or write single or multiple elements to a power monitor using PLC5 or SLC Typed messages in RSLogix5. This setup applies to PLC5 programmable logic controllers.

Follow these steps to configure a message.

1. Choose an available message data block in your message instruction.

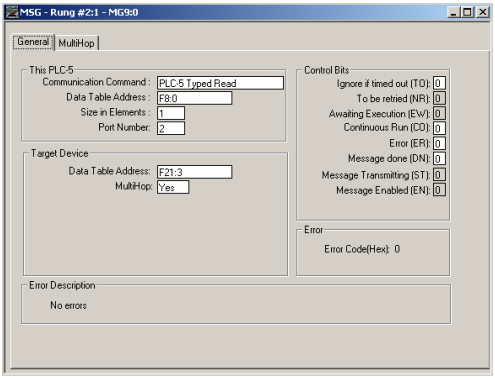
   In this example, we used MG9:0.

2. Click Setup Screen at the bottom of the message instruction.

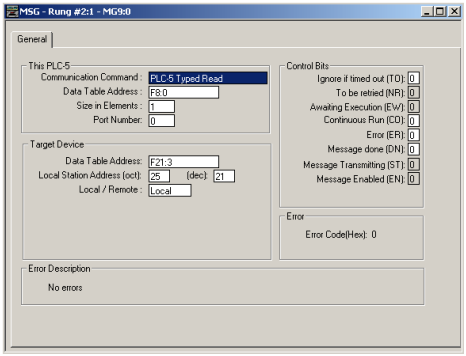
   The message configuration window for either Ethernet network or Serial communcation appears.

3. Choose the appropriate parameters in the Message Configuration window.

Ethernet Network Communication



Serial Communication

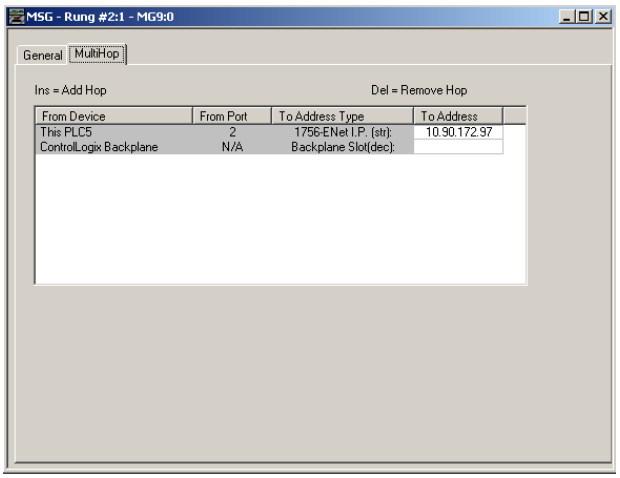


Communication Type	Parameter	Choice
Ethernet	Communication Command	Select the appropriate message type according to Message Type on page 54.
	Data Table Address (This Controller)	Read: This is the controller tag in which to store the data being read.
		Write: This is the controller tag that stores the value to be written to the power monitor.
	Size in Elements	This is the number of elements being read or written to. If you are performing a single element read or write, then this value should be 1. If you are performing a multiple element read or write, then this should be the number of elements after the source element that you wish to read or write.
	Port Number	2
	Data Table Address (Target Device)	Refer to Appendix A for the address of the specific data value you're reading or writing to.
	MultiHop	Yes
Serial	Communication Command	Select the appropriate message type according to Message Type on page 54.
	Data Table Address	Read: This is the controller tag in which to store the data being read.
		Write: This is the controller tag that stores the value to be written to the power monitor.
	Size in Elements	This is the number of elements being read or written to. If you are performing a single element read or write, then this value should be 1. If you are performing a multiple element read or write, then this should be the number of elements after the source element that you wish to read or write.
	Port Number	0
	Data Table Address (Target Device)	Refer to Appendix A for the address of the specific data value you're reading or writing to.
	Local Station Address	This is the serial node address of your power monitor.
	Local / Remote	Local

Message setup is complete for Serial communication.

4. Click the MultiHop tab if configuring Ethernet communication.

5. Enter the IP Address of the power monitor in the first row of the To Address column.



Message setup is complete.

Reading Logs

You can perform explicit messages to read data from log records in the power monitor.

For information on setting up explicit messages to the power monitor, please refer to Explicit Message Setup – Examples on page 53.

The following logs can be read into a controller depending on the logs supported by your power monitor.

- Unit Status Log
- Min/Max Log
- Energy Log
- Load Factor Log
- Time of Use Log kWh
- Time of Use Log kVAR
- Time of Use Log kVA

Please refer to Appendix A for the data table address of the specific log you are requesting.

Log Data Table Methodology

The log data tables only hold one record instance for a specific log. Successive reads of the data table return a successive record instance for that log. By writing to specific configuration elements in the Log Request Table data table, you can configure the log to return in a forward or reverse direction. You can also configure the log to return a specific record for all logs except the Unit Status Log, and Energy Log.

Refer to Log Request Table on page 85 for more information.

Example 1: Read the 5th Log Record in the Load Factor Log

This example explains how to configure the Log Request Table to read the 5th log record in the Load Factor Log.

1. Create a write message to write the following values to the Log Request Table.

Element	Item Name	Value
0	Selected Log	4
1	Chronology of Auto Return Data	0
2	Mix/Max Record to be Returned	0
3	Number of Unit Status Records	0
4	Number of Energy Log Records	0
5	Number of Time of Use Log Records	0
6	Number of Load Factor Log Records	0
7	Load Factor or TOU Record to be Returned	5

2. Create a read message to read the values in the Load Factor Log table.

Example 2: Read Min/Max Log for Average Current

This example explains how to configure the Log Request Table to read the Min/Max log for Average Current.

Refer to Min/Max Parameter List on page 103 for the specific record to return.

In this example, Average Current is record 4.

1. Create a write message to write the following values to the Log Request Table.

Element	Item Name	Value
0	Selected Log	2
1	Chronology of Auto Return Data	0
2	Mix/Max Record to be Returned	4
3	Number of Unit Status Records	0
4	Number of Energy Log Records	0
5	Number of Time of Use Log Records	0
6	Number of Load Factor Log Records	0
7	Load Factor or TOU Record to be Returned	0

2. Create a read message to read the values in the Min/Max Log table.

Calculating Energy Log Depth

How long the Energy Log takes to fill may be as little as 288 hours or as long as three years depending on how you configure the log rate. The Energy records maximum depth is 17280 records that covers the following:

- Status 1 and 2 counters
- Real, Reactive, and Apparent Demand
- Real, Reactive, and Apparent Energy
- Demand Power Factor

PowerMonitor 1000 Data Tables

Summary of Data Tables

The Summary of PowerMonitor 1000 Data Tables for all Communication Protocols table summarizes all data tables available and their general attributes

The rest of the tables detail each specific data table and its associated elements, such as Modbus address, default value, ranges, and description.

IMPORTANT The lock symbol designates that the parameter that is marked will not be able to be written when the hardware lock terminals are connected together.

Table 1 - Summary of PowerMonitor 1000 Data Tables for all Communication Protocols

Name of Data Table	Data Access	CSP File No.	CIP Ass'y Inst.	Modbus Addressing Range	No of Elements	TR1	TR2	EM1	EM2	EM3	Refer to Page
User Configured Table Results	R	F9	1	31601…31632	16					•	69
Analog Input Configuration	RW	F10	3	40001…40014	7	•	•	•	•	•	70
Advanced Configuration	RW	F11	4	40101…40144	22	•	•	•	•	•	71
RS485 Configuration	RW	N12	5	40201…40209	9	•	•	•	•	•	74
Ethernet Configuration	RW	N13	6	40301…40323	23 good	•	•	•	•	•	75
Time Zone Information											77
Date and Time Configuration	RW	N14	7	40401…40408	8	•	•	•	•	•	79
Log Configuration	RW	N15	8	40501…40512	12 good			•	•	•	80
Command	W	F16	9	40601…40644	22	•	•	•	•	•	83
Log Request	RW	N17	10	40701…40711	11	•	•	•	•	•	85
Controller Interface	W	N18	11	40801…40808	8 good				•	•	87
Discrete Result	R	N19	12	30001…30006	6	•	•	•	•	•	88
Wiring Diagnostics Results	R	F20	13	30101…30142	21	•	•	•	•	•	89
Volts, Amps, and Frequency Results	R	F21	14	30201…30232	16	•	•			•	91
Power Results	R	F22	15	30301…30334	17	•	•			•	92
Energy Results	R	F23	16	30401…30438	19			•	•	•	93
Demand Results	R	F24	17	30501…30518	9				•	•	94
Unit Status Log Results	R	N25	18	30601…30613	13 good	•	•	•	•	•	95
Unit Status Log Code											96
Energy Log Results	R	F26	19	30701…30742	21 good			•	•	•	98
Write Error Status Results	R	N27	20	30801…30803	3 good	•	•	•	•	•	99

Table 1 - Summary of PowerMonitor 1000 Data Tables for all Communication Protocols

Name of Data Table	Data Access	CSP File No.	CIP Ass'y Inst.	Modbus Addressing Range	No of Elements	TR1	TR2	EM1	EM2	EM3	Refer to Page
Unit Run Status Results	R	N28	21	30901…30925	25	•	•	•	•	•	100
Min/Max Log Results	R	F29	22	31001…31022	11 good	•	•			•	102
Min/Max Parameter List						•	•			•	103
Load Factor Log Results	R	F30	23	31101…31128	14 good				•	•	104
Time of Use Log Results- Real Energy and Demand	R	F31	24	31201…31224	12 good			•	•	•	106
Time of Use Log Results - Reactive Energy and Demand	R	F32	25	31301…31324	12 good				•	•	107
Time of Use Log Results - Apparent Energy and Demand	R	F33	26	31401…31424	12 good				•	•	108
Catalog Number and WIN	R	N34	27	31501…31519	19 good	•	•	•	•	•	109
Single Element Password Write	W	N35	28	40901	1 good	•	•	•	•	•	110
User-configurable Table Setup	R/W	N44	29	41001…41017	17					•	111
Parameters for Configurable Table											112

Data Tables

Table 2 - User Configured Table Results Parameters

CSP File No.	F9
CIP Instance	1
Applies to	EM3 only
No. of Elements	16
No. of Words	32
Data Type	Float
Data Access	Read Only

Table 3 - User Configured Table Results

Element No.	Modbus Address	Element Name	Description
0	31601-2	User selected Parameter #1	Parameters previously setup during a write to User-configured Table Setup table.
1	31603-4	User selected Parameter #2	
2	31605-6	User selected Parameter #3	
3	31607-8	User selected Parameter #4	
4	31609-10	User selected Parameter #5	
5	31611-12	User selected Parameter #6	
6	31613-14	User selected Parameter #7	
7	31615-16	User selected Parameter #8	
8	31617-18	User selected Parameter #9	
9	31619-20	User selected Parameter #10	
10	31621-22	User selected Parameter #11	
11	31623-24	User selected Parameter #12	
12	31625-26	User selected Parameter #13	
13	31627-28	User selected Parameter #14	
14	31629-30	User selected Parameter #15	
15	31631-32	User selected Parameter #16	

Table 4 - Analog Input Configuration Parameters

CSP File No.	F10
CIP Instance	3
Applies to	All models
No. of Elements	7
No. of Words	14
Data Type	Float
Data Access	Read/Write

Table 5 - Analog Input Configuration

Element No.	Modbus Address	Element Name	Default Value	Range	Description
0	40001-2	Password	0	0…9999	When writing the complete table this parameter allows the input data to be accepted. When writing a single parameter the separate password table should be used. Returns -1 on a read.
1	40003-4	Voltage Mode	2	0…4	Should match the external electrical system and how it is wired to the PowerMonitor's voltage and current input terminals. Refer to the installation manual wiring diagrams. 0 = Direct Delta 1 = Open Delta 2 = Wye 3 = Single Phase 4 = Demo
2	40005-6	PT Primary	480	1.00… 50,000	The first value of the PT ratio (xxx:xxx) indicating the nominal voltage present at the high-end of the transformer. If no transformer is used (for direct connect of up to 347V L-N or 600V L-L), set the PT ratio to any valid 1:1 ratio (for example 480:480).
3	40007-8	PT Secondary	480	1.00… 600.00	The second value of the PT ratio (xxx:xxx) indicating the nominal voltage present at the low-end of the transformer.
4	40009-10	CT Primary	5	5.00… 50,000	The first value of the CT ratio (xxx:5) indicating the nominal current present at the high-end (primary side) of the transformer. Example: PRI = 1000. Setting = 1000:5. 5 A is the nominal secondary current of the CT.
5	40011-12	System PF Setting	2	0…2	0 = Leading -97…89 1 = High -85…98 2 = Low -52…-95
6	40013-14	Reserved	0	0	Reserved for future use.

Table 6 - Advanced Configuration Parameters

CSP File No.	F11
CIP Instance	4
No. of Elements	22
No. of Words	44
Data Type	Float
Data Access	Read/Write

Table 7 - Advanced Configuration

Element No.	Modbus Address Range	Element Name	Default Value	Range	TR1	TR2	EM1	EM2	EM3	Description
0	40101-2	Password	0	0…9999	•	•	•	•	•	When writing the complete table this parameter allows the input data to be accepted. When writing a single parameter the separate password table should be used. Returns -1 on a read.
1	40103-4	New Password	0	0…9999	•	•	•	•	•	This becomes the new password when the proper the configuration password entry has been made and this parameter is greater than (-1).
2	40105-5	Metering Result Averaging	1	0…1	•	•	•	•	•	The metering results for volts, amps, power and frequency is averaged over 8 cycles of data to provide a steady output reading. 0 = Off 1 = On
3	40107-8	Log Status Input Changes	0	0…1	•	•	•	•	•	0 = Disable recording of status input changes into the status log. 1 = Enable recording of status input changes into the status log.
4	40109-10	Use Daylight Savings Correction	0	0…1	•	•	•	•	•	0 = Disable Daylight Savings 1 = Enable Daylight Savings
5	40111-12	Daylight Savings Month/Week/ Day Start	030201 March, 2nd, Sunday	10101… 120507	•	•	•	•	•	This is the day that the power monitor will add an hour to the time. This feature also looks at Ethernet SNTP offset and corrects for Daylight Savings. Example: 040107 = April/1st week/Sunday Month Settings: 01 = January…12 = December Week Settings: 01 = 1st week…05 = Last Week Day of the Week Settings: 01 = Sunday…07 = Saturday
6	40113-14	Hour of Day Start	2	0…23	•	•	•	•	•	The hour of day the daylight savings adjustment should be made to add an hour.

Table 7 - Advanced Configuration

Element No.	Modbus Address Range	Element Name	Default Value	Range	TR1	TR2	EM1	EM2	EM3	Description
7	40115-16	Return from Daylight Savings Month/Week/ Day	110101 November, 1st, Sunday	10101… 120507	•	•	•	•	•	This is the day that the power monitor will subtract an hour from the time. This feature also looks at Ethernet SNTP offset and corrects for the return from Daylight Savings. Month Settings: 01 = January…12 = December Week Settings: 01 = 1st week…05 = Last Week Day of the Week Settings: 01 = Sunday…07 = Saturday
8	40117-18	Hour of Day End	2	0…23	•	•	•	•	•	The hour of day the daylight savings adjustment should be made to subtract an hour.
9 🔒	40119-20	KYZ Solid State Output Parameter	0	0…5			•	•	•	The parameter selected will pulse the KYZ output at a rate that equals the parameter value divided by KYZ scale. 0 = Disable 1 = Wh Fwd 2 = Wh Rev 3 = VARh Fwd (EM2 and EM3 Only) 4 = VARh Rev (EM2 and EM3 Only) 5 = Vah (EM2 and EM3 Only)
10 🔒	40121-22	KYZ Solid State Output Scale	1,000	1… 100,000			•	•	•	The KYZ output parameter divided by the scale is the output pulse rate. Example: Wh is selected for the parameter and 1,000 is the scale value. The output is pulsed every kWh.
11 🔒	40123-24	KYZ Pulse Duration Setting	250 ms	0 or 50…1000			•	•	•	Set as 50…1000 to indicate the duration of the pulse in milliseconds, or set to 0 for KYZ-style transition output. (Toggle) The value for delay is rounded off to the nearest 10ms internally during this function.
12 🔒	40125-26	Status Input 1 Input Scale	1	1… 1,000,000			•	•	•	When a status pulse is received the count is increased by the scale factor. Input pulse * input scale added to total status count.
13 🔒	40127-28	Status Input 2 Input Scale	1	1… 1,000,000			•	•	•	When a status pulse is received the count is increased by the scale factor. Input pulse * input scale added to total status count.
14 🔒	40129-30	Demand Source	0	0…3				•	•	When item Demand Broadcast Master Select of the ethernet table is set to master a selection of 0 through 2 sets the type of master input. In this case item 3 is ignored. When the Demand Broadcast Master Select of the ethernet table is set to slave then any of these inputs can set the end of the demand period. Selections of 0 through 2 can be selected for RS485 units. 0 = Internal Timer 1 = Status Input 2 2 = Controller Command 3 = Ethernet Demand Broadcast Selection 3 can only be programmed when the Ethernet option is installed.

Table 7 - Advanced Configuration

Element No.	Modbus Address Range	Element Name	Default Value	Range	TR1	TR2	EM1	EM2	EM3	Description
15 🔒	40131-32	Demand Period Length	15 min	0…99				•	•	Specifies the desired period for demand calculations. When set to 0 there are no projected demand calculations. If the internal timer is selected a setting of 0 turns the demand function off.
16 🔒	40133-34	Number of Demand Periods	1	1…15				•	•	Specifies the number of demand periods to average for demand measurement.
17 🔒	40135-36	Forced Demand Sync Delay	10 s	0…900 s				•	•	When the power monitor is configured for external demand control the unit delays for xxx seconds after the expected control pulse has not been received. The demand period starts over and a record is recorded in the status log. 0 = Wait forever 1…900 = Wait this many seconds before starting a new demand period. This setting becomes active when the demand interval is set from -1…-99 minutes.
18	40137-38	Unit Error Action	1	0…1	•	•	•	•	•	This parameter determines the action when a unit error occurs. 0 = Halt on error and make status LED solid red 1 = Reset power monitor hardware.
19	40139-40	Software Error Log Full Action	1	0…1	•	•	•	•	•	This parameter determines the action when a firmware failure is detected and the error log is full. 0 = Halt on error and wait for clear log command, also make status LED solid red 1 = Perform a firmware reset.
20	40141-42	Reserved	0	0	•	•	•	•	•	Reserved for future use.
21	40143-44	Reserved	0	0	•	•	•	•	•	Reserved for future use.

Table 8 - Serial RS-485 Port Configuration Parameters

CSP File No.	N12
CIP Instance	5
Applies to	All models
No. of Elements	9
No. of Words	9
Data Type	Integer
Data Access	Read/Write

Table 9 - Serial RS-485 Port Configuration

Element No.	Modbus Address	Element Name	Default Value	Range	Description
0	40201	Password	0	0…9999	When writing the complete table this parameter allows the input data to be accepted. When writing a single parameter the separate password table should be used. Returns -1 on a read.
1	40202	Protocol Setting	1	0…3	The protocol selection for communication. 0 = DF1 Half Duplex Slave 1 = DF1 Full Duplex 2 = Modbus RTU Slave 3 = Auto Sense 4 = DH485
2	40203	Serial Delay	2 (10 ms)	1…15	The setting times 5 = milliseconds that the unit waits before responding to a communication request. Useful for consistent communication and slow devices.
3	40204	Baud Rate	5	0…6	The serial communication baud rate. 0 = 1200 1 = 2400 2 = 4800 3 = 9600 4 = 19200 5 = 38,400 6 = 57,600
4	40205	DF1, DH485, Modbus Address	Device ID, 31 for DH485	1…247 (DF1, Modbus) 0…31 (DH485)	During production the Device ID is printed on the nameplate. This ID then becomes the default address for DF1 and Modbus.
5	40206	Data Format	0	0…2 (2 for DH485)	Parity, number of data bits, number of stop bits 0 = No parity, 8 data bits, 1 stop bit 1 = Odd parity, 8 data bits, 1 stop bit 2 = Even parity, 8 data bits, 1 stop bit
6	40207	Inter Character Timeout	0	0… 6553	Specifies the minimum delay between characters that indicates the end of a message packet for Modbus protocol. 0 = 3.5 character times in default. The unit is ms.
8	40208	Maximum Node Address	3	1…31	Specifies the maximum node address on a DH485 network.
9	40209	Reserved	0	0	Reserved for future use.

Table 10 - Ethernet Configuration Parameters

CSP File No.	N13
CIP Instance	6
No. of Elements	23
No. of Words	23
Data Type	Integer
Data Access	Read/Write

Table 11 - Ethernet Configuration

Element No.	Modbus Address	Element Name	Default Value	Range	TR1	TR2	EM1	EM2	EM3	Description
0	40301	Password	0	0…9999	•	•	•	•	•	When writing the complete table this parameter allows the input data to be accepted. When writing a single parameter the separate password table should be used. Returns -1 on a read.
1	40302	IP Address Byte a (aaa.xxx.xxx.xxx)	192	0…255	•	•	•	•	•	The 1st Octet of the Static IP Address.
2	40303	IP Address Byte b (xxx.bbb.xxx.xxx)	168	0…255	•	•	•	•	•	The 2nd Octet of the Static IP Address.
3	40304	IP Address Byte c (xxx.xxx.ccc.xxx)	254	0…255	•	•	•	•	•	The 3rd Octet of the Static IP Address.
4	40305	IP Address Byte d (xxx.xxx.ddd.xxx)	Unit ID	0…255	•	•	•	•	•	The 4th Octet of the Static IP Address.
5	40306	Subnet Mask Byte a	255	0…255	•	•	•	•	•	Specifies the subnet mask to apply to the IP address.
6	40307	Subnet Mask Byte b	255	0…255	•	•	•	•	•	Specifies the subnet mask to apply to the IP address.
7	40308	Subnet Mask Byte c	0	0…255	•	•	•	•	•	Specifies the subnet mask to apply to the IP address.
8	40309	Subnet Mask Byte d	0	0…255	•	•	•	•	•	Specifies the subnet mask to apply to the IP address.
9	40310	Gateway IP Address Byte a	128	0…255	•	•	•	•	•	IP address of the gateway to other subnets for wide area networking.
10	40311	Gateway IP Address Byte b	1	0…255	•	•	•	•	•	IP address of the gateway to other subnets for wide area networking.
11	40312	Gateway IP Address Byte c	1	0…255	•	•	•	•	•	IP address of the gateway to other subnets for wide area networking.
12	40313	Gateway IP Address Byte d	1	0…255	•	•	•	•	•	IP address of the gateway to other subnets for wide area networking.

Table 11 - Ethernet Configuration

Element No.	Modbus Address	Element Name	Default Value	Range	TR1	TR2	EM1	EM2	EM3	Description
13	40314	SNTP Mode Select	0	0…2	•	•	•	•	•	This mode selects the mode of the SNTP function or to disable the SNTP function. 0 = Disable 1 = Unicast - The SNTP address points to a unicast server. 2 = Anycast Mode - The SNTP address is a broadcast address of an anycast group.
14	40315	SNTP Update Interval	300	1…32766	•	•	•	•	•	Indicates how often the time is updated from the SNTP Server. The unit is minute.
15	40316	Time Zone Select	7	0…32	•	•	•	•	•	The time zone table has detailed time zone information.
16	40317	Time Server IP Address Byte a	0	0…255	•	•	•	•	•	The internal clock is set after each Time set interval has expired. The Time server IP address is the SNTP time server where the request is handled.
17	40318	Time Server IP Address Byte b	0	0…255	•	•	•	•	•	The internal clock is set after each Time set interval has expired. The Time server IP address is the SNTP time server where the request is handled.
18	40319	Time Server IP Address Byte c	0	0…255	•	•	•	•	•	The internal clock is set after each Time set interval has expired. The Time server IP address is the SNTP time server where the request is handled.
19	40320	Time Server IP Address Byte d	0	0…255	•	•	•	•	•	The internal clock is set after each Time set interval has expired. The Time server IP address is the SNTP time server where the request is handled.
20	40321	Demand Broadcast Master Select	0	0…1				•	•	When configured as a Master the power monitor broadcasts an end of demand interval broadcast to the UDP port number configured. 0 = Slave 1 = Master control
21	40322	Broadcast Port Number	300	300…400				•	•	When configured as a Master and External Demand Source or Ethernet Demand Broadcast the port number is the listening or broadcast port for the UDP message.
22	40323	Reserved	0	0	•	•	•	•	•	Reserved for future use.

Table 12 - Time Zone Information

Value	Offset from GMT	Time Zone Name	Areas in Time Zone
0	GMT-12:00	Dateline Standard Time	Eniwetok, Kwajalein
1	GMT-11:00	Samoa Standard Time	Midway Island, Samoa
2	GMT-10:00	Hawaiian Standard Time	Hawaii
3	GMT-09:00	Alaskan Standard Time	Alaska
4	GMT-08:00	Pacific Standard Time	Pacific Time (US & Canada,; Tijuana)
5	GMT-07:00	Mountain Standard Time	Mountain Time (US & Canada)
		US Mountain Standard Time	Arizona
6	GMT-06:00	Canada Central Standard Time	Saskatchewan
		Central America Standard Time	Central America
		Central Standard Time	Central Time (US & Canada)
		Mexico Standard Time	Mexico City
7	GMT-05:00	Eastern Standard Time	Eastern Time (US & Canada)
		SA Pacific Standard Time	Bogota, Lima, Quito
		US Eastern Standard Time	Indiana (East)
8	GMT-04:00	Atlantic Standard Time	Atlantic Time (Canada)
		Pacific SA Standard Time	Santiago
		SA Western Standard Time	Caracas, La Paz
9	GMT-03:30	Newfoundland Standard Time	Newfoundland
10	GMT-03:00	E. South America Standard Time	Brasilia
		Greenland Standard Time	Greenland
		SA Eastern Standard Time	Buenos Aires, Georgetown
11	GMT-02:00	Mid-Atlantic Standard Time	Mid-Atlantic
12	GMT-01:00	Azores Standard Time	Azores
		Cape Verde Standard Time	Cape Verde Is.
13	GMT	Standard Time	Greenwich Mean Time: Dublin, Edinburgh, Lisbon, London
		Greenwich Standard Time	Casablanca, Monrovia
14	GMT+01:00	Central Europe Standard Time	Belgrade, Bratislava, Budapest, Ljubljana, Prague
		Central European Standard Time	Sarajevo, Skopje, Sofija, Vilnius, Warsaw, Zagreb
		Romance Standard Time	Brussels, Copenhagen, Madrid, Paris
		W. Central Africa Standard Time	West Central Africa
		W. Europe Standard Time	Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
15	GMT+02:00	E. Europe Standard Time	Bucharest
		Egypt Standard Time	Cairo
		FLE Standard Time	Helsinki, Riga, Tallinn
		GTB Standard Time	Athens, Istanbul, Minsk
		Israel Standard Time	Jerusalem
		South Africa Standard Time	Harare, Pretoria

Table 12 - Time Zone Information

Value	Offset from GMT	Time Zone Name	Areas in Time Zone
16	GMT+03:00	Arab Standard Time	Kuwait, Riyadh
		Arabic Standard Time	Baghdad
		E. Africa Standard Time	Nairobi
		Russian Standard Time	Moscow, St. Petersburg, Volgograd
17	GMT+03:30	Iran Standard Time	Tehran
18	GMT+04:00	Arabian Standard Time	Abu Dhabi, Muscat
		Caucasus Standard Time	Baku, Tbilisi, Yerevan
19	GMT+04:30	Afghanistan Standard Time	Kabul
20	GMT+05:00	Ekaterinburg Standard Time	Ekaterinburg
		West Asia Standard Time	Islamabad, Karachi, Tashkent
21	GMT+05:30	India Standard Time	Calcutta, Chennai, Mumbai, New Delhi
22	GMT+05:45	Nepal Standard Time	Kathmandu
23	GMT+06:00	Central Asia Standard Time	Astana, Dhaka
		N. Central Asia Standard Time	Almaty, Novosibirsk
		Sri Lanka Standard Time	Sri Jayawardenepura
24	GMT+06:30	Myanmar Standard Time	Rangoon
25	GMT+07:00	North Asia Standard Time	Krasnoyarsk
		SE Asia Standard Time	Bangkok, Hanoi, Jakarta
26	GMT+08:00	China Standard Time	Beijing, Chongqing, Hong Kong, Urumqi
		North Asia East Standard Time	Irkutsk, Ulaan Bataar
		Singapore Standard Time	Kuala Lumpur, Singapore
		Taipei Standard Time	Taipei
		W. Australia Standard Time	Perth
27	GMT+09:00	Korea Standard Time	Seoul
		Tokyo Standard Time	Osaka, Sapporo, Tokyo
		Yakutsk Standard Time	Yakutsk
28	GMT+09:30	AUS Central Standard Time	Darwin
		Cen. Australia Standard Time	Adelaide
29	GMT+10:00	AUS Eastern Standard Time	Canberra, Melbourne, Sydney
		E. Australia Standard Time	Brisbane
		Tasmania Standard Time	Hobart
		Vladivostok Standard Time	Vladivostok
		West Pacific Standard Time	Guam, Port Moresby
30	GMT+11:00	Central Pacific Standard Time	Magadan, Solomon Is., New Caledonia
31	GMT+12:00	Fiji Standard Time	Fiji, Kamchatka, Marshall Is.
		New Zealand Standard Time	Auckland, Wellington
32	GMT+13:00	Tonga Standard Time	Nuku'alofa

Table 13 - Date and Time Configuration Parameters

CSP File No.	N14
CIP Instance	7
Applies to	All models
No. of Elements	8
No. of Words	8
Data Type	Integer
Data Access	Read/Write

Table 14 - Date and Time Configuration

Element No.	Modbus Address	Element Name	Default Value	Range	Description
0	40401	Password	0	0…9999	When writing the complete table this parameter allows the input data to be accepted. When writing a single parameter the separate password table should be used. Returns -1 on a read.
1	40402	Date: Year	2005	2001… 2100	The range is from 2001… 2100. A write sets the current year.
2	40403	Date: Month	1	1…12	A write sets the current month. A read returns current month. 1=January, 2=February,…12=December
3	40404	Date: Day	1	1…31	A write sets the current day of the month. A reads returns the current day of the month. The internal real-time clock adjusts the date for leap-year.
4	40405	Time: Hour	0	0…23	A write sets the current hour. A read returns the current hour. 0=12am, 1=1am,…23=11pm The internal real-time clock does not adjust for daylight savings time.
5	40406	Time: Minute	0	0…59	A write sets the current minutes. A read returns the current minutes.
6	40407	Time: Seconds	0	0…59	A write sets the current seconds. A read returns the current seconds.
7	40408	Time: Hundredths	0	0…99	Set this element to 0 for writes. Returns hundredths of a second on read.

Table 15 - Log Configuration Parameters

CSP File No.	N15
CIP Instance	8
No. of Elements	12
No. of Words	12
Data Type	Integer
Data Access	Read/Write

Table 16 - Log Configuration

Element No.	Modbus Address	Element Name	Default Value	Range	TR1	TR2	EM1	EM2	EM3	Description
0	40501	Password	0	0… 9999			•	•	•	When writing the complete table this parameter allows the input data to be accepted. When writing a single parameter the separate password table should be used. Returns -1 on a read.
1	40502	Energy Log Interval	15 min	-1…60			•	•	•	Selects how often a record is logged (minutes). A value of 0 disables periodic logging of records. A value of –1 causes logging of records to be synchronized to the end of the demand interval.
2	40503	Energy Log Mode	1	0…1			•	•	•	This parameter set the action of the log once is has filled to capacity. Setting the option to 0 allows the log to fill but stops at the end. Option 1 lets the log fill and then oldest records are deleted and replaced with new records. 0 = Fill and Stop 1 = Overwrite, When the log is filled new records replace the oldest records.
3	40504	Time of Use Log Auto Log Setting	31	0…31			•	•	•	Automatically stores the current record for the month replacing the oldest record if the log is full. The log holds 12 months plus the current record. 0 = Disables the auto clear feature. 1 = Store and clear the table on the 1st day of each month. 2 = 2nd Day 3 = 3rd day … 29…31 = Store and clear table at the last day of the month.

Table 16 - Log Configuration

Element No.	Modbus Address	Element Name	Default Value	Range	TR1	TR2	EM1	EM2	EM3	Description
4	40505	Off Peak Days	65	0…127			•	•	•	This bit map field selects the off peak days. OFF-PEAK days have only one rate for billing. Bit0= Sunday Bit1= Monday Bit2= Tuesday Bit3= Wednesday Bit4= Thursday Bit5= Friday Bit6= Saturday Saturday and Sunday are default Off Peak days.
5	40506	MID Peak AM Hours	1792	0… 4095			•	•	•	This bit map selects any AM hours that are designated as MID Peak. Example: The hours from 8 AM to 11AM is designated as bit 8 through bit 10 = 1792d. Bit0= 12 AM…1 AM Bit1= 1 AM…2 AM Bit2= 2 AM…3 AM … … Bit11= 11AM…12 AM Default is 8 AM…11 AM
6	40507	MID Peak PM Hours	120	0… 4095			•	•	•	This bit map selects any PM hours that are designated as MID Peak. Example: The hours from 3 PM to 7 PM is designated as bit 3 through bit 6 = 120d. Bit0= 12 PM…1 PM Bit1= 1 PM…2 PM Bit2= 2 PM…3 PM … … Bit11= 11PM…12 PM Default is 3 PM…7 PM
7	40508	ON Peak AM Hours	2048	0… 4095			•	•	•	This bit map selects any AM hours that are designated as ON Peak. Example: The hours from 11AM to 12 PM is designated as bit 11 = 2048d. Bit0= 12 AM…1 AM Bit1= 1 AM…2 AM Bit2= 2 AM…3 AM … Bit11= 11AM…12 AM Default is 11AM
8	40509	ON Peak PM hours	7	0…4095			•	•	•	This bit map selects any PM hours that are designated as ON Peak. Example: The hours from 12 PM to 3 PM is designated as bit 0 through bit 2 = 7d Bit0= 12 PM…1 PM Bit1= 1 PM…2 PM Bit2= 2 PM…3 PM … Bit11= 11PM…12 PM Default is 12 PM…3 PM

Table 16 - Log Configuration

Element No.	Modbus Address	Element Name	Default Value	Range	TR1	TR2	EM1	EM2	EM3	Description
9	40510	Load Factor log Auto Log Setting	31	0…31			•	•	•	Automatically stores the current peak, average, and load factor results as a record in the non-volatile load factor log and resets the log at the specified day of the month. 0 = Disables the auto clear feature. 1 = Store and clear the table on the 1st day of each month. 2 = 2nd Day 3 = 3rd day … 29…31 = Store and clear table at the last day of the month.
10	40511	Reserved	0	0	•	•	•	•	•	Reserved for future use.
11	40512	Reserved	0	0	•	•	•	•	•	Reserved for future use.

Table 17 - Command Table Parameters

CSP File No.	F16
CIP Instance	9
No. of Elements	22
No. of Words	44
Data Type	Float
Data Access	Write

Table 18 - Command Table

Element No.	Modbus Address	Element Name	Default Value	Range	TR1	TR2	EM1	EM2	EM3	Description
0	40601-2	Password	0	0…9999	•	•	•	•	•	When writing the complete table this parameter allows the input data to be accepted. When writing a single parameter the separate password table should be used. Returns -1 on a read.
1	40603-4	Command Word 1	0	0…32	•	•	•	•	•	These commands can be sent to the power monitor. When using the optional elements the command table must be sent complete with all elements present. If the single password table is used to gain access to configuration items then the command can be sent alone without optional settings. The command options are: 0 = No Action 1 = Set kWh Register 2 = Set kVARh Register 3 = Set kVAh Register 4 = Clear All Energy Registers 5 = Set Status 1 Count 6 = Set Status 2 Count 7 = Clear Energy Log 8 = Force KYZ Output On 9 = Force KYZ Output Off 10 = Remove Force from KYZ 11 = Restore Factory Defaults 12 = Perform Wiring Diagnostics 13 = Reset power monitor System 14…32 = Reserved If a command is received that is not supported by your catalog number the command will be ignored.
2	40605-6	Command Word 2	0	0…32	•	•	•	•	•	0 = No Action 1 = Clear Min/Max Records 2 = Store and clear current Load Factor Record 3 = Clear Load Factor Log 4 = Store and clear current TOU Record 5 = Clear TOU Log 6 = Clear Error Log command 7 = Troubleshooting Mode Enable 8…32 = Reserved. If a command is received that is not supported by your catalog number the command will be ignored.
3	40607-8	Clear Single Min/ Max Records	0	0…35 0…31 0…19	•	•			•	When setting the Min/Max Clear bit this value can be sent to specify a single parameter. If clearing all values this is not required. EM3 = 0…35 TR2 = 0…31 TR1 = 0…19 0=Clear All Parameters 1= Clear the 1st Min/Max Record 2= Clear the 2nd Min/Max Record … 35=Clear the 35th Min/Max Record

Table 18 - Command Table

Element No.	Modbus Address	Element Name	Default Value	Range	TR1	TR2	EM1	EM2	EM3	Description
4	40609-10	Status 1 Count x M Register Set Value	0	0… 9,999,999			•	•	•	Status 1 Count Register Start Value x 1,000,000
5	40611-12	Status 1 Count X 1 Register Set Value	0	0… 999,999			•	•	•	Status 1 Count Register Start Value x 1
6	40613-14	Status 2 Count x M Register Set Value	0	0… 9,999,999			•	•	•	Status 2 Count Register Start Value x 1,000,000
7	40615-16	Status 2 Count X 1 Register Set Value	0	0… 999,999			•	•	•	Status 2 Count Register Start Value x 1
8	40617-18	GWh Fwd Register Set Value	0	0… 9,999,999			•	•	•	Sets the GWh Fwd Register to the desired Value
9	40619-20	kWh Fwd Register Set Value	0	0… 999,999			•	•	•	Sets the kWh Fwd Register to the desired Value
10	40621-22	GWh Rev Register Set Value	0	0… 9,999,999			•	•	•	Sets the GWh Rev Register to the desired Value
11	40623-24	kWh Rev Register Set Value	0	0… 999,999					•	Sets the kWh Rev Register to the desired Value
12	40625-26	GVARh Fwd Register Set Value	0	0… 9,999,999				•	•	Sets the GVARh Fwd Register to the desired Value
13	40627-28	kVARh Fwd Register Set Value	0	0… 999,999				•	•	Sets the kVARh Fwd Register to the desired Value
14	40629-30	GVARh Rev Register Set Value	0	0… 9,999,999				•	•	Sets the GVARh Rev Register to the desired Value
15	40631-32	kVARh Rev Register Set Value	0	0… 999,999				•	•	Sets the kVARh Rev Register to the desired Value
16	40633-34	GVAh Register Set Value	0	0… 9,999,999				•	•	Sets the GVAh Register to the desired Value
17	40635-36	kVAh Register Set Value	0	0… 999,999				•	•	Sets the kVAh Register to the desired Value
18	40637-38	Troubleshooting Password	0	0	•	•	•	•		Password for Troubleshooting Mode provided by the password generator program.
19	40639-40	Reserved	0	0	•	•	•	•	•	Reserved for future use.
20	40641-42	Reserved	0	0	•	•	•	•	•	Reserved for future use.
21	40643-44	Reserved	0	0	•	•	•	•	•	Reserved for future use.

Table 19 - Log Request Table Parameters

CSP File No.	N17
CIP Instance	10
No. of Elements	11
No. of Words	11
Data Type	Integer
Data Access	Read/Write

Table 20 - Log Request Table

Element No.	Modbus Address	Element Name	Default Value	Range	TR1	TR2	EM1	EM2	EM3	Description
0	40701	Selected Log	0	0…5	•	•	•	•	•	Selects the log that information is returned from. Once a single request has been made the auto return feature will bring back successive records each time the log is read. Some logs support individual record requests. 1 = Unit Status Log 2 = Min/Max Log 3 = Energy Log 4 = Load Factor Log 5 = Time of Use Log kWh 6 = Time of Use Log kVAR 7 = Time of Use Log kVA If your catalog number does not support the requested log item the power monitor will ignore the request.
1	40702	Chronology of Auto Return Data	1	0…1	•	•	•	•	•	The date chronology of the returned records. 0 = Reverse direction 1 = Forward direction
2	40703	The Min/Max record to be returned	0	0…35 0…31 0…15	•	•			•	Selects the Min/Max record number to be returned. See the table for Min/Max record list. 0 = Use incremental return and the chronology selected. EM3 = 1…35 TR2 = 1…31 TR1 = 1…15
3	40704	Number of Unit Status Records	-	1…50	•	•	•	•	•	On a read of this table the value of this parameter is the number of Unit Status Records available. This log is only returned using the incremental return method.
4	40705	Number of Energy Log Records	-	0… 17,280			•	•	•	On a read of this table the value of this parameter is the number of Energy Log Records available.

Table 20 - Log Request Table

Element No.	Modbus Address	Element Name	Default Value	Range	TR1	TR2	EM1	EM2	EM3	Description
5	40706	Number of Time of Use Log Records	-	1…13			•	•	•	On a read of this table the value of this parameter is the number of Time of Use Log Records available. One is the current record being updated before logging.
6	40707	Number of Load Factor Log Records	-	1…13				•	•	On a read of this table the value of this parameter is the number of Load Factor Log Records available. One is the current record being updated before logging.
7	40708	Load Factor or TOU Record to be Returned.	-	0…13	•	•	•	•	•	Selects the Load Factor or TOU record number to be returned. 0 = Use incremental return and the chronology selected 1 through 13 selects an individual record.
8	40709	Reserved	-	0	•	•	•	•	•	Reserved for future use.
9	40710	Reserved	-	0	•	•	•	•	•	Reserved for future use.
10	40711	Reserved	-	0	•	•	•	•	•	Reserved for future use.

Table 21 - Controller Interface Table Parameters

CSP File No.	N18
CIP Instance	11
Applies to	EM2, EM3 only
No. of Elements	8
No. of Words	8
Data Type	Integer
Data Access	Write

Table 22 - Controller Interface Table

Element No.	Modbus Address	Element Name	Default Value	Range	Description
0	40801	Password	0	0…9999	When writing the complete table this parameter allows the input data to be accepted. When writing a single parameter the separate password table should be used. Returns -1 on a read.
1	40802	Controller Command Word	0	0…1	Bit 0 = When this bit is written to the power monitor it signals the end of the demand period. The power monitor resets the bit to 0 and sends the end of demand broadcast to all of the slaves configured for the master/slave demand system. The power monitor must be configured as a Master for external demand pulse input. Bit 1…15 = Reserved
2	40803	Reserved	0	0	Reserved for future use.
3	40804	Reserved	0	0	Reserved for future use.
4	40805	Reserved	0	0	Reserved for future use.
5	40806	Reserved	0	0	Reserved for future use.
6	40807	Reserved	0	0	Reserved for future use.
7	40808	Reserved	0	0	Reserved for future use.

Table 23 - Discrete Results Parameters

CSP File No.	N19
CIP Instance	12
Applies to	All models
No. of Elements	6
No. of Words	6
Data Type	Integer
Data Access	Read

Table 24 - Discrete Results

Element No.	Modbus Address	Element Name	Range	Description
0	30001	Status Input States	0…3	Indicates the current states of the status input. Bit 0 = Status 1 activated Bit 1 = Status 2 activated Bit 2…15 = Reserved
1	30002	Output Word	0…15	Bit 0 = KYZ relay actuated Bit 1 = KYZ output forced on Bit 2 = KYZ output forced off Bit 3 = External demand pulse timeout Bit 4 = Terminal Locked Bit 5…15 = Reserved
2	30003	Reserved	0	Reserved for future use.
3	30004	Reserved	0	Reserved for future use.
4	30005	Reserved	0	Reserved for future use.
5	30006	Reserved	0	Reserved for future use.

Table 25 - Wiring Diagnostics Results Parameters

CSP File No.	F20
CIP Instance	13
No. of Elements	21
No. of Words	42
Data Type	Float
Data Access	Read

Table 26 - Wiring Diagnostics Results

Element No.	Modbus Address	Element Name	Units	Range	TR1	TR2	EM1	EM2	EM3	Description
0	30101-2	Wiring Status		0…5	•	•	•	•	•	This is the overall status of the wiring diagnostic test. 0 = Pass 1 = Failed 2 = Input Level Low 3 = Disabled 4 = Waiting Command 5 = Out of range
1	30103-4	Voltage Input Missing		-1…123	•	•	•	•	•	Reports on all three phases. -1 = Test not run. 0 = Test passed. 1 = Phase 1 missing 2 = Phase 2 missing 3 = Phase 3 missing 12 = Phase 1 and 2 missing 13 = Phase 1 and 3 missing 23 = Phase 2 and 3 missing 123 = All phases missing
2	30105-6	Voltage Input Inverted		-1…123	•	•	•	•	•	Reports on all three phases. -1 = Test not run. 0 = Test passed. 1 = Phase 1 inverted 2 = Phase 2 inverted 3 = Phase 3 inverted 12 = Phase 1 and 2 inverted 13 = Phase 1 and 3 inverted 23 = Phase 2 and 3 inverted 123 = All phases inverted
3	30107-8	Current Input Missing		-1…123	•	•	•	•	•	Reports on all three phases. -1 = Test not run. 0 = Test passed. 1 = Phase 1 missing 2 = Phase 2 missing 3 = Phase 3 missing 12 = Phase 1 and 2 missing 13 = Phase 1 and 3 missing 23 = Phase 2 and 3 missing 123 = All phases missing

Table 26 - Wiring Diagnostics Results

Element No.	Modbus Address	Element Name	Units	Range	TR1	TR2	EM1	EM2	EM3	Description
4	30109-10	Current Input Inverted		-1…123	•	•	•	•	•	Reports on all three phases. -1 = Test not run. 0 = Test passed. 1 = Phase 1 inverted 2 = Phase 2 inverted 3 = Phase 3 inverted 12 = Phase 1 and 2 inverted 13 = Phase 1 and 3 inverted 23 = Phase 2 and 3 inverted 123 = All phases inverted
5	30111-12	Voltage Rotation		-1…132	•	•	•	•	•	Reports on all three phases. The reported sequence represents each phase. Example: 123 = Phase 1 then phase 2 then phase 3 -1 = Test not run 4 = Invalid rotation 1…132 designating phase and rotation.
6	30113-14	Current Rotation		-1…321	•	•	•	•	•	Reports on all three phases. The reported sequence represents each phase. Example: 123 = Phase 1 then phase 2 then phase 3 -1 = Test not run 4 = Invalid rotation 1…321 designating phase and rotation.
7	30115-16	Voltage Phase 1 Angle	Degrees	0…359.99	•	•			•	Shows the present phase angle of this channel. Should always be 0 degrees for voltage phase 1.
8	30117-18	Voltage Phase 1 Magnitude	Volts	0…9,999,999	•	•			•	Shows the present magnitude of this phase.
9	30119-20	Voltage Phase 2 Angle	Degrees	0…359.99	•	•			•	Shows the present phase angle of this channel.
10	30121-22	Voltage Phase 2 Magnitude	Volts	0…9,999,999	•	•			•	Shows the present magnitude of this phase.
11	30123-24	Voltage Phase 3 Angle	Degrees	0…359.99	•	•			•	Shows the present phase angle of this channel.
12	30125-26	Voltage Phase 3 Magnitude	Volts	0…9,999,999	•	•			•	Shows the present magnitude of this phase.
13	30127-28	Current Phase 1 Angle	Degrees	0…359.99	•	•			•	Shows the present phase angle of this channel.
14	30129-30	Current Phase 1 Magnitude	Amperes	0…9,999,999	•	•			•	Shows the present magnitude of this phase.
15	30131-32	Current Phase 2 Angle	Degrees	0…359.99	•	•			•	Shows the present phase angle of this channel.
16	30133-34	Current Phase 2 Magnitude	Amperes	0…9,999,999	•	•			•	Shows the present magnitude of this phase.
17	30135-36	Current Phase 3 Angle	Degrees	0…359.99	•	•			•	Shows the present phase angle of this channel.

Table 26 - Wiring Diagnostics Results

Element No.	Modbus Address	Element Name	Units	Range	TR1	TR2	EM1	EM2	EM3	Description
18	30137-38	Current Phase 3 Magnitude	Amperes	0…9,999,999	•	•			•	Shows the present magnitude of this phase.
19	30139-40	Degrees out of range		0…360	•	•	•	•	•	When Status = 5, how many degrees out of range.
20	30141-42	Reserved		0	•	•	•	•	•	Reserved for future use

Table 27 - Volts, Amps, Frequency Results Parameters

CSP File No.	F21
CIP Instance	14
No. of Elements	16
No. of Words	32
Data Type	Float
Data Access	Read

Table 28 - Volts, Amps, Frequency Results

Element No.	Modbus Address	Element Name	Range	TR1	TR2	EM1	EM2	EM3	Description
0	30201-2	L1 Current	0.000…9,999,999	•	•			•	Phase 1 scaled RMS Current
1	30203-4	L2 Current	0.000…9,999,999	•	•			•	Phase 2 scaled RMS Current
2	30205-6	L3 Current	0.000…9,999,999	•	•			•	Phase 3 scaled RMS Current
3	30207-8	Average Current	0.000…9,999,999	•	•			•	Average RMS Current
4	30209-10	L1-N Volts	0.000…9,999,999	•	•			•	Phase 1 scaled RMS Voltage
5	30211-12	L2-N Volts	0.000…9,999,999	•	•			•	Phase 2 scaled RMS Voltage
6	30213-14	L3-N Volts	0.000…9,999,999	•	•			•	Phase 3 scaled RMS Voltage
7	30215-16	Average L-N Volts	0.000…9,999,999	•	•			•	Averaged RMS Voltage
8	30217-18	L1-L2 Volts	0.000…9,999,999	•	•			•	Line 1 to Line 2 Volts
9	30219-20	L2-L3 Volts	0.000…9,999,999	•	•			•	Line 2 to Line 3 Volts
10	30221-22	L3-L1 Volts	0.000…9,999,999	•	•			•	Line 3 to Line 1 Volts
11	30223-24	Average L-L Volts	0.000…9,999,999	•	•			•	Average Line to Line Volts
12	30225-26	Frequency	40.0 Hz…70.0 Hz	•	•			•	Last frequency reading.
13	30227-28	Percent Current Unbalance	0.0…100.0	•	•			•	Percent maximum deviation from Ave. / Ave.
14	30229-30	Percent Voltage Unbalance	0.0…100.0	•	•			•	Percent Maximum deviation from Ave. / Ave.
15	30231-32	Metering Iteration	0…9,999,999	•	•			•	Increments by 1 for each new metering calculation.

Table 29 - Power Results Parameters

CSP File No.	F22
CIP Instance	15
No. of Elements	17
No. of Words	34
Data Type	Float
Data Access	Read

Table 30 - Power Results

Element No.	Modbus Address	Element Name	Range	TR1	TR2	EM1	EM2	EM3	Description
0	30301-2	L1 True Power Factor	-100.0…+100.0		•			•	Percent ratio between power and apparent power. The value is signed to (+) leading and (-) lagging.
1	30303-4	L2 True Power Factor	-100.0…+100.0		•			•	
2	30305-6	L3 True Power Factor	-100.0…+100.0		•			•	
3	30307-8	3 Phase True Power Factor	-100.0…+100.0		•			•	
4	30309-10	L1 kWatts	+/- 0.000…9,999,999		•			•	Line 1 kWatts
5	30311-12	L2 kWatts	+/- 0.000…9,999,999		•			•	Line 2 kWatts
6	30313-14	L3 kWatts	+/- 0.000…9,999,999		•			•	Line 3 kWatts
7	30315-16	Total kWatts	+/- 0.000…9,999,999		•			•	Total kWatts
8	30317-18	L1 kVAR	+/- 0.000…9,999,999		•			•	Line 1 kVAR
9	30319-20	L2 kVAR	+/- 0.000…9,999,999		•			•	Line 2 kVAR
10	30321-22	L3 kVAR	+/- 0.000…9,999,999		•			•	Line 3 kVAR
11	30323-24	Total kVAR	+/- 0.000…9,999,999		•			•	Total kVAR
12	30325-26	L1 kVA	0.000…9,999,999		•			•	Line 1 kVA
13	30327-28	L2 kVA	0.000…9,999,999		•			•	Line 2 kVA
14	30329-30	L3 kVA	0.000…9,999,999		•			•	Line 3 kVA
15	30331-32	Total kVA	0.000…9,999,999		•			•	Total kVA
16	30333-34	Metering Iteration	0…9,999,999		•			•	Increments by 1 for each new metering calculation.

IMPORTANT Only total power values are returned in delta wiring modes. Zeroes are returned for individual phase values.

Table 31 - Energy Results Parameters

CSP File No.	F23
CIP Instance	16
No. of Elements	19
No. of Words	38
Data Type	Float
Data Access	Read

Table 32 - Energy Results

Element No.	Modbus Address	Element Name	Range	TR1	TR2	EM1	EM2	EM3	Description
0	30401-2	Status 1 Count xM	0…9,999,999			•	•	•	Status 1 Count times 1,000,000
1	30403-4	Status 1 Count x1	0…999,999			•	•	•	Status 1 count times 1
2	30405-6	Status 2 Count xM	0…9,999,999			•	•	•	Status 2 Count times 1,000,000
3	30407-8	Status 2 Count x1	0…999,999			•	•	•	Status 2 count times 1
4	30409-10	GWh Fwd	0…9,999,999			•	•	•	Forward gigawatt hours
5	30411-12	kWatth Fwd	0.000…999,999			•	•	•	Forward kilowatt hours
6	30413-14	GWh Rev.	0…9,999,999			•	•	•	Reverse gigawatt hours
7	30415-16	kWatth Rev.	0.000…999.999			•	•	•	Reverse kilowatt hours
8	30417-18	GWh Net	+/- 0…9,999,999			•	•	•	Net gigawatt hours
9	30419-20	kWatth Net	+/- 0.000…999,999			•	•	•	Net kilowatt hours
10	30421-22	GVARH Fwd	0…9,999,999				•	•	Forward gigaVAR hours
11	30423-24	kVARh Fwd	0.000…999,999				•	•	Forward kiloVAR hours
12	30425-26	GVARH Rev.	0…9,999,999				•	•	Reverse gigaVAR hours
13	30427-28	kVARh Rev.	0.000…999,999				•	•	Reverse kiloVAR hours
14	30429-30	GVARH Net	+/- 0…9,999,999				•	•	Net gigaVAR hours
15	30431-32	kVARh Net	+/- 0.000…999,999				•	•	Net kiloVAR hours
16	30433-34	GVAh Net	0…9,999,999				•	•	Net gigaVA hours
17	30435-36	kVAh	0.000…999,999				•	•	Net kiloVA hours
18	30437-38	Metering Iteration	0…9,999,999			•	•	•	Increments by 1 for each new metering calculation.

Table 33 - Demand Results Parameters

CSP File No.	F24
CIP Instance	17
No. of Elements	9
No. of Words	18
Data Type	Float
Data Access	Read

Table 34 - Demand Results

Element No.	Modbus Address	Element Name	Range	TR1	TR2	EM1	EM2	EM3	Description
0	30501-2	kWatt Demand	+/- 0.000…9,999,999				•	•	The average real power during the last demand period.
1	30503-4	kVAR Demand	+/- 0.000…9,999,999				•	•	The average reactive power during the last demand period.
2	30505-6	kVA Demand	0.000…9,999,999				•	•	The average apparent power during the last demand period.
3	30507-8	Demand PF	-100.0…+100.0				•	•	The average demand for PF during the last demand period.
4	30509-10	Projected kWatt Demand	+/- 0.000…9,999,999				•	•	The projected total real power for the current period.
5	30511-12	Projected kVAR Demand	+/- 0.000…9,999,999				•	•	The projected total reactive power for the current period.
6	30513-14	Projected kVA Demand	0.000…9,999,999				•	•	The projected total apparent power for the current period.
7	30515-16	Elapsed Demand Period Time	0.00…99.99				•	•	The amount of time that has elapsed during the current period.
8	30517-18	Metering Iteration	0…9,999,999				•	•	Increments by 1 for each new metering calculation.

Table 35 - Unit Status Log Results Parameters

CSP File No.	N25
CIP Instance	18
Applies to	All models
No. of Elements	13
No. of Words	13
Data Type	Integer
Data Access	Read

Table 36 - Unit Status Log Results

Element No.	Modbus Address	Element Name	Range	Description
0	30601	Status Record Internal Identifier	1…50	Used to verify record sequence when returning multiple records.
1	30602	Timestamp Year of record	-	The year when the record was recorded.
2	30603	Timestamp Month/Day	-	The month and day when the record was recorded.
3	30604	Timestamp Hour/Minute	-	The hour and minute when the record was recorded.
4	30605	Timestamp Seconds/Hundredths	-	The seconds and hundredths when the record was recorded.
5	30606	Status Event Type	0…512	Indicates the type of status event that has occurred.
6	30607	General Code	0…4096	Indicates general information about the status event.
7	30608	Information Code	0…256	Indicates specific information about the status event.
8	30609	Reserved	0	Reserved for future use.
9	30610	Reserved	0	Reserved for future use.
10	30611	Reserved	0	Reserved for future use.
11	30612	Reserved	0	Reserved for future use.
12	30613	Reserved	0	Reserved for future use.

Table 37 - Unit Status Log Codes

Status Event Type (Decimal)	Event #	General Code (Decimal)	Code #	Information Code (Decimal)	Code #
Self Test Status	1	Pass	0		
		Flash Memory	1	Overall Status	1
				Boot Code Checksum	2
				Application Code Checksum	4
				Calibration Data CRC	8
				No Calibration Data	16
				Wrong Application FRN	32
				Invalid Model Type	64
				WIN Mismatch	128
				Missing Upgrade Block	256
		SRAM	2	Failed Read/Write Test	1
		NVRAM	4	Failed Read/Write Test	1
		SPI Interface	8	SPI Device Not Responding	1
				SPI Interface Failed	2
		Real Time Clock	16	Real Time Clock Failed	1
				Real Time Clock not Set	2
		Watchdog Timer	32	Watchdog Time Out	1
		Metering	64	Metering Status Failed	1
		LCD Interface	128	LCD Interface Failure	1
		Serial Communications	256	Serial Communication Port Failed	1
		Ethernet Communications	512	Ethernet Communications Port Failed	1
				Modbus Stack Initialization Failed	2
				Demand Broadcast Thread Init Failed	4
				SNTP Thread Init Failed	8
		Input Over Range	1024	Input Over Range Voltage	1
				Input Over Range Current	2
		Voltage Phase Loss	2048	Voltage Channel 1 Loss	1
				Voltage Channel 2 Loss	2
				Voltage Channel 3 Loss	4
		Process Error	4096		

Table 37 - Unit Status Log Codes

Status Event Type (Decimal)	Event #	General Code (Decimal)	Code #	Information Code (Decimal)	Code #
Configuration Changed	2	Clock Set	1		
		Status Input Counter Set	2	Status Input 1	1
				Status Input 2	2
				All Status Input	4
		Factory Defaults Restored	4		
		Energy Register Set	8	Wh Register	1
				VARh Register	2
				VAh Register	4
				All Energy Registers Cleared	8
		Terminal Locked	16		
		Terminal Unlocked	32		
Log Cleared or Set	4	Min/Max Log Cleared	1		
		Energy Log Cleared	2		
		LoadFactor Log Cleared	4		
		TOU Log Cleared	8		
KYZ Forced	8	KYZ Forced On	1		
		KYZ Forced Off	2		
Status Input Activated	16	Status Input 1	1		
		Status Input 2	2		
Status Input Deactivated	32	Status Input 1	1		
		Status Input 2	2		
Energy Register Rollover	64	Wh Register	1		
		VARh Register	2		
		VAh Register	4		
		Status Input 1 Register	8		
		Status Input 2 Register	16		
Device Power Up	128				
Device Power Down	256				
Missed External Demand Sync	512				

Table 38 - Energy Log Results Parameters

CSP File No.	F26
CIP Instance	19
No. of Elements	21
No. of Words	42
Data Type	Float
Data Access	Read

Table 39 - Energy Log Results

Element No.	Modbus Address	Element Name	Range	TR1	TR2	EM1	EM2	EM3	Description
0	30701-2	Internal Record Identifier.				•	•	•	
1	30703-4	Timestamp Year of record	-			•	•	•	The date and time when the record was recorded.
2	30705-6	Timestamp Month/ Day	-			•	•	•	
3	30707-8	Timestamp Hour/ Minute	-			•	•	•	
4	30709-10	Timestamp Seconds/ Hundredths	-			•	•	•	
5	30711-12	Status 1 Count xM	0…9,999,999			•	•	•	Status 1 Count times 1,000,000
6	30713-14	Status 1 Count x1	0…999,999			•	•	•	Status 1 count times 1
7	30715-16	Status 2 Count xM	0…9,999,999			•	•	•	Status 2 Count times 1,000,000
8	30717-18	Status 2 Count x1	0…999,999			•	•	•	Status 2 count times 1
9	30719-20	GWh Net	+/- 0…9,999,999			•	•	•	Net gigawatt hours
10	30721-22	kWatth Net	+/- 0.000…999,999			•	•	•	Net kilowatt hours
11	30723-24	GVARH Net	+/- 0…9,999,999				•	•	Net gigaVAR hours
12	30725-26	kVARh Net	+/- 0.000…999,999				•	•	Net kiloVAR hours
13	30727-28	GVAh Net	0…9,999,999				•	•	Net gigaVA hours
14	30729-30	kVAh Net	0.000…999,999				•	•	Net kiloVA hours
15	30731-32	kWatt Demand	+/- 0.000…9,999,999				•	•	The average real power during the last demand period.
16	30733-34	kVAR Demand	+/- 0.000…9,999,999				•	•	The average reactive power during the last demand period.
17	30735-36	kVA Demand	0.000…9,999,999				•	•	The average apparent power during the last demand period.
18	30737-38	Demand PF	-100.0…+100.0				•	•	The average demand for PF during the last demand period.
19	30739-40	Reserved	0				•	•	Reserved for future use.
20	30741-42	Reserved	0				•	•	Reserved for future use.

Table 40 - Write Error Status Results Parameters

CSP File No.	N27
CIP Instance	20
Applies to	All Models
No. of Elements	3
No. of Words	3
Data Type	Integer
Data Access	Read

Table 41 - Write Error Status Results

Element No.	Modbus Address	Element Name	Range	Description
0	30801	Table Number or Instance	All Write Enabled Tables	Indicates the last table that was written.
1	30802	Offending Element	Length of current table - 1	If the most recent write was successful this returns a (-1). If the write was unsuccessful this is the first rejected element in the table write.
2	30803	Terminal Lock On	0…1	If a write was made to a table that has elements that are locked this value is 1.

Table 42 - Unit Run Status Results Parameters

CSP File No.	N28
CIP Instance	21
Applies to	All models
No. of Elements	25
No. of Words	25
Data Type	Integer
Data Access	Read

Table 43 - Unit Run Status Results

Element No.	Modbus Address	Element Name	Range	Description
0	30901	Bulletin Number	1408	Always returns 1408
1	30902	Series Letter	0…8	Indicates the unit hardware series letter, for example. 0 = A 1 = B . . 8 = H
2	30903	Catalog Device Type	0…4	The catalog number type of this device. 0 = TR1 1 = TR2 2 = EM1 3 = EM2 4 = EM3
3	30904	Communication Type	0…1	The communication type of this device 0 = Serial only 1 = both serial and Ethernet
4	30905	Application FRN	-	The current firmware revision
5	30906	Boot Code FRN	-	The current boot code revision
6	30907	Default Device ID	1…247	A semi-unique number assigned to a device at the time it is manufactured. Used for out of the box communication over DF1 and Ethernet.
7	30908	Accuracy Class	0…3	Indicates the revenue metering accuracy class of the power monitor as it is shipped from the factory. 0 = No Class Designation 1 = Class 1 2 = Class 0.5 3 = Class 0.2
8	30909	Overall Status	0…16383	0 indicates normal operation. Each bit indicates a different fault condition. Bit 0 = Flash Memory Bit 1 = SRAM Bit 2 = NVRAM Bit 3 = SPI Interface Bit 4 = Real Time Clock Bit 5 = Watchdog Timer Bit 6 = Metering Bit 7 = LCD Interface Bit 8 = Serial Communications Bit 9 = Ethernet Communications Bit 10 = Error Log Full

Table 43 - Unit Run Status Results

Element No.	Modbus Address	Element Name	Range	Description
9	30910	Flash Memory	0…511	0 indicates normal operation. Status bits are Bit 0 = Overall status Bit 1 = Boot code checksum Bit 2 = Application code checksum Bit 3 = Calibration data CRC Bit 4 = No calibration data Bit 5 = Wrong application FRN Bit 6 = Invalid model type Bit 7 = WIN mismatch Bit 8 = missing upgrade block
10	30911	SRAM	0…1	0 indicates normal operation. Bit 0 = Read/write test
11	30912	NVRAM	0…1	0 indicates normal operation. Bit 0 = Read/write test
12	30913	SPI Interface	0…1	0 indicates normal operation. Bit 0 = SPI device not responding
13	30914	Real Time Clock	0…3	0 indicates normal operation. Bit 0 = RTC status Bit 1 = Time Zone Set Failed
14	30915	Watchdog Timer	0…1	0 indicates normal operation. Bit 0 = Watchdog time out
15	30916	Metering	0…1	0 indicates normal operation. Bit 0 = Metering status
16	30917	LCD Interface	0…1	0 indicates normal operation. Bit 0 = LCD Interface status
17	30918	Serial Communications	0…1	0 indicates normal operation. Bit 0 = Serial Interface status
18	30919	Ethernet Communications	0…511	0 indicates normal operation. Bit 0 = Ethernet Communications status Bit 1 = SNTP Server timeout status Bit 2 = Duplicate IP Address status Bit 3 = Invalid IP/Netmask address Bit 4 = Invalid gateway address Bit 5 = Invalid SNTP time server address Bit 6 = Modbus stack run status Bit 7 = Demand broadcast thread run status Bit 8 = SNTP thread run status
19	30920	Input Over Range	0…3	0 indicates normal operation. Bit 0 = Voltage Input over range Bit 1 = Current Input over range
20	30921	Phase Loss Detection	0…7	0 Indicates normal running condition. Bit 0 = Loss of phase A Bit 1 = Loss of phase B Bit 2 = Loss of phase C
21	30922	Configuration Locked	0…1	Reports 1 if configuration lock is applied.
22	30923	Password Accepted	0…1	1 indicates the password is verified and active
23	30924	Error Recorded	0	Is incremented by 1 when an internal error happens
24	30925	Troubleshooting Times Remaining	0…30	Remaining times for troubleshooting mode.

Table 44 - Min/Max Log Results Parameters

CSP File No.	F29
CIP Instance	22
No. of Elements	11
No. of Words	22
Data Type	Float
Data Access	Read

Table 45 - Min/Max Log Results

Element No.	Modbus Address	Element Name	Range	TR1	TR2	EM1	EM2	EM3	Description
0	31001-2	Parameter Being Returned	1…35	•	•			•	Indicates the Parameter Number (See Min/Max Parameter List).
1	31003-4	MIN Value	+/- 0.000…9,999,999	•	•			•	The minimum value recorded for parameter being returned since the last clear command.
2	31005-6	MAX Value	+/- 0.000…9,999,999	•	•			•	The maximum value recorded for parameter being returned since the last clear command.
3	31007-8	Timestamp Year of MIN		•	•			•	The year when the MIN value was recorded.
4	31009-10	Timestamp Month/Day of MIN		•	•			•	The month and day when the MIN value was recorded.
5	31011-12	Timestamp Hour/Minute of MIN		•	•			•	The hour and minute when the MIN value was recorded.
6	31013-14	Timestamp Seconds/Hundredths of MIN		•	•			•	The seconds and hundredths when the MIN value was recorded.
7	31015-16	Timestamp Year of MAX		•	•			•	The year when the MAX value was recorded.
8	31017-18	Timestamp Month/Day of MAX		•	•			•	The month and day when the MAX value was recorded.
9	31019-20	Timestamp Hour/Minute of MAX		•	•			•	The hour and minute when the MAX value was recorded.
10	31021-22	Timestamp Seconds/Hundredths of MAX		•	•			•	The seconds and hundredths when the MAX value was recorded.

Table 46 - Min/Max Parameter List

No.	Parameter	TR1	TR2	EM3
1	L1 Current	•	•	•
2	L2 Current	•	•	•
3	L3 Current	•	•	•
4	Average Current	•	•	•
5	L1-N Volts	•	•	•
6	L2-N Volts	•	•	•
7	L3-N Volts	•	•	•
8	Average L-N Volts	•	•	•
9	L1-L2 Volts	•	•	•
10	L2-L3 Volts	•	•	•
11	L3-L1 Volts	•	•	•
12	Average L-L Volts	•	•	•
13	Frequency	•	•	•
14	Percent Current Unbalance	•	•	•
15	Percent Voltage Unbalance	•	•	•
16	L1 True Power Factor		•	•
17	L2 True Power Factor		•	•
18	L3 True Power Factor		•	•
19	3 Phase True Power Factor		•	•
20	L1 kWatts		•	•
21	L2 kWatts		•	•
22	L3 kWatts		•	•
23	Total kWatts		•	•
24	L1 kVAR		•	•
25	L2 kVAR		•	•
26	L3 kVAR		•	•
27	Total kVAR		•	•
28	L1 kVA		•	•
29	L2 kVA		•	•
30	L3 kVA		•	•
31	Total kVA		•	•
32	kWatt Demand			•
33	kVAR Demand			•
34	kVA Demand			•
35	PF Demand			•

Table 47 - Load Factor Log Results Parameters

CSP File No.	F30
CIP Instance	23
No. of Elements	14
No. of Words	28
Data Type	Float
Data Access	Read

Table 48 - Load Factor Log Results

Element No.	Modbus Address	Element Name	Range	TR1	TR2	EM1	EM2	EM3	Description
0	31101-2	Record Number	1…13				•	•	The record number of this data.
1	31103-4	End Date yy/mm/dd	-				•	•	The date that this record was stored.
2	31105-6	Elapsed Time	0.000… 9,999,999				•	•	Amount of time (in hours) that has elapsed since the last clear of the peak and average values. Updated at the end of each demand interval.
3	31107-8	Peak Demand kWatts	+/- 0.000…9,999,999				•	•	The largest magnitude demand for kwatts that occurred over all of the demand intervals since the last clear command or auto-clear day.
4	31109-10	Average Demand kWatts	+/- 0.000…9,999,999				•	•	A running average of demand for kwatts from the end of each demand period since the last clear command or auto-clear day.
5	31111-12	Load Factor kWatts	0…100%				•	•	Average Demand kW / Peak Demand kW. This is a demand management metric that indicates how 'spiky' (or 'level') a load is over a period of time (usually 1 month). A value approaching 100% indicates a constant load.
6	31113-14	Peak Demand kVAR	+/- 0.000… 9,999,999				•	•	The largest magnitude demand for kVAR that occurred over all of the demand intervals since the last clear command or auto-clear day.
7	31115-16	Average Demand kVAR	+/- 0.000… 9,999,999				•	•	A running average of demand for kVAR from the end of each demand period since the last clear command or auto-clear day.
8	31117-18	Load Factor kVAR	0…100%				•	•	Average Demand kVAR / Peak Demand kVAR. This is a demand management metric that indicates how 'spiky' (or 'level') a load is over a period of time (usually 1 month). A value approaching 100% indicates a constant load.

Table 48 - Load Factor Log Results

Element No.	Modbus Address	Element Name	Range	TR1	TR2	EM1	EM2	EM3	Description
9	31119-20	Peak Demand kVA	0.000… 9,999,999				•	•	The largest magnitude demand for kVA that occurred over all of the demand intervals since the last clear command or auto-clear day.
10	31121-22	Average Demand kVA	0.000… 9,999,999				•	•	A running average of demand for kVA from the end of each demand period since the last clear command or auto-clear day.
11	31123-24	Load Factor kVA	0…100%				•	•	Average Demand kVA / Peak Demand kVA. This is a demand management metric that indicates how 'spiky' (or 'level') a load is over a period of time (usually 1 month). A value approaching 100% indicates a constant load.
12	31125-26	Reserved	0				•	•	Reserved for Future Use
13	31127-28	Reserved	0				•	•	Reserved for Future Use

Table 49 - Time of Use Log Results - Real Energy and Demand Parameters

CSP File No.	F31
CIP Instance	24
No. of Elements	12
No. of Words	24
Data Type	Float
Data Access	Read

Table 50 - Time of Use Log Results - Real Energy and Demand

Element No.	Modbus Address	Element Name	Range	TR1	TR2	EM1	EM2	EM3	Description
0	31201-2	Record Number	1…13			•	•	•	The record number of the log. Record 0 is always the current record before being logged.
1	31203-4	Time Stamp Start Date (yy/mm/dd)	-			•	•	•	The Date this record was started.
2	31205-6	Time Stamp End Date (yy/mm/dd)	-			•	•	•	The Date this record was ended.
3	31207-8	Off Peak GWh Net	+/- 0… 9,999,999			•	•	•	Net Off Peak giga watt hours
4	31209-10	Off Peak kWh Net	+/- 0.000… 999,999			•	•	•	Net Off Peak kilo watt hours
5	31211-12	Off Peak kW Demand	+/- 0.000… 9,999,999			•	•	•	Off Peak Demand for kilo watts
6	31213-14	Mid Peak GWh Net	+/- 0… 9,999,999			•	•	•	Net Mid Peak giga watt hours
7	31215-16	Mid Peak kWh Net	+/- 0.000… 999,999			•	•	•	Net Mid Peak kilowatt hours
8	31217-18	Mid Peak kW Demand	+/- 0.000… 9,999,999			•	•	•	Mid Peak Demand for kilo watts
9	31219-20	On Peak GWh Net	+/- 0.000… 9,999,999			•	•	•	Net On Peak giga watt hours
10	31221-22	On Peak kWh Net	+/- 0… 999,999			•	•	•	Net On Peak kilo watt hours
11	31223-24	On Peak kW Demand	+/- 0.000… 9,999,999				•	•	On Peak Demand for kilo watts

Table 51 - Time of Use Log Results - Reactive Energy and Demand Parameters

CSP File No.	F32
CIP Instance	25
No. of Elements	12
No. of Words	24
Data Type	Float
Data Access	Read

Table 52 - Time of Use Log Results - Reactive Energy and Demand

Element No.	Modbus Address	Element Name	Range	TR1	TR2	EM1	EM2	EM3	Description
0	31301-2	Record Number	1…13			•	•	•	The record number of the log. Record 0 is always the current record before being logged.
1	31303-4	Time Stamp Start Date (yy/mm/dd)	-			•	•	•	The Date this record was started.
2	31305-6	Time Stamp End Date (yy/mm/dd)	-			•	•	•	The Date this record was ended.
3	31307-8	Off Peak GVARH Net	+/- 0… 9,999,999			•	•	•	Net Off peak giga VAR hours
4	31309-10	Off Peak kVARh Net	+/- 0.000… 999,999			•	•	•	Net Off Peak kilo VAR hours
5	31311-12	Off Peak kVAR Demand	+/- 0.000… 9,999,999			•	•	•	Off Peak Demand for kilo VAR
6	31313-14	Mid Peak GVARH Net	+/- 0… 9,999,999			•	•	•	Net Mid Peak giga VAR hours
7	31315-16	Mid Peak kVARh Net	+/- 0.000… 999,999			•	•	•	Net Mid Peak kilo VAR hours
8	31317-18	Mid Peak kVAR Demand	+/- 0.000… 9,999,999			•	•	•	Mid Peak Demand for kilo VAR
9	31319-20	On Peak GVARH Net	+/- 0.000… 9,999,999			•	•	•	Net On Peak giga VAR hours
10	31321-22	On Peak kVARh Net	+/- 0… 999,999			•	•	•	Net On Peak kilo VAR hours
11	31323-24	On Peak kVAR Demand	+/- 0.000… 9,999,999				•	•	On Peak Demand for kilo VAR

Table 53 - Time of Use Log Results - Apparent Energy and Demand Parameters

CSP File No.	F33
CIP Instance	26
No. of Elements	12
No. of Words	24
Data Type	Float
Data Access	Read

Table 54 - Time of Use Log Results - Apparent Energy and Demand

Element No.	Modbus Address	Element Name	Range	TR1	TR2	EM1	EM2	EM3	Description
0	31401-2	Record Number	1…13			•	•	•	The record number of the log. Record 0 is always the current record before being logged.
1	31403-4	Time Stamp Start Date (yy/mm/dd)	-			•	•	•	The Date this record was started.
2	31405-6	Time Stamp End Date (yy/mm/dd)	-			•	•	•	The Date this record was ended.
3	31407-8	Off Peak GVAh Net	+/- 0… 9,999,999			•	•	•	Net Off peak giga VA hours
4	31409-10	Off Peak kVAh Net	+/- 0.000… 999,999			•	•	•	Net Off Peak kilo VA hours
5	31411-12	Off Peak kVA Demand	+/- 0.000… 9,999,999			•	•	•	Off Peak Demand for kilo VA
6	31413-14	Mid Peak GVAh Net	+/- 0… 9,999,999			•	•	•	Net Mid Peak giga VA hours
7	31415-16	Mid Peak kVAh Net	+/- 0.000… 999,999			•	•	•	Net Mid Peak kilo VA hours
8	31417-18	Mid Peak kVA Demand	+/- 0.000… 9,999,999			•	•	•	Mid Peak Demand for kilo VA
9	31419-20	On Peak GVAh Net	+/- 0.000… 9,999,999			•	•	•	Net On Peak giga VA hours
10	31421-22	On Peak kVAh Net	+/- 0… 999,999			•	•	•	Net On Peak kilo VA hours
11	31423-24	On Peak kVA Demand	+/- 0.000… 9,999,999				•	•	On Peak Demand for kilo VA

Table 55 - Catalog Number and WIN Parameters

CSP File No.	N34
CIP Instance	27
Applies to	All models
No. of Elements	19
No. of Words	19
Data Type	Integer
Data Access	Read

Table 56 - Catalog Number and WIN

Element No.	Modbus Address	Element Name	Range	Description
0	31501	Catalog # text char pair #1	0…32767	Contains the product number (example: 1408-EM3A-485A, but with out the dashes). A read of this table returns the catalog # as 4 integers: each integer contains a character pair. For each character pair, character 1=integer/256 and character 2 = remainder of integer/256.
1	31502	Catalog # text char pair #2		
2	31503	Catalog # text char pair #3		
3	31504	Catalog # text char pair #4		
4	31505	Catalog # text char pair #4		
5	31506	Catalog # text char pair #4		
6	31507	Reserved	0	Reserved for future use.
7	31508	Hardware Series	0…25	Indicates the product series letter. For example, 0=A, 1=B,
8	31509	WIN # text char pair #1	0…32767	Contains the product WIN(Warranty Identification Number). This is the same alpha-numeric string that can be found on the master module label (example: 21AW0AT5HO). 5 integers each contains two characters as displayed by the Catalog parameter method.
9	31510	WIN # text char pair #2		
10	31511	WIN# text char pair #3		
11	31512	WIN# text char pair #4		
12	31513	WIN# text char pair #5		
13	31514	Reserved	0	Reserved for future use.
14	31515	Reserved	0	Reserved for future use.
15	31516	Original Model	0...10	This number represents the catalog number type. 0 = TR1 1 = TR2 2 = EM1 3 = EM2 4 = EM3 5 through 10 = Reserved
16	31517	Current Model	0...10	The current model of the product. This can be the same as the original model (if no upgrades have been performed).
17	31518	Reserved	0	Reserved for future use.
18	31519	Reserved	0	Reserved for future use.

Table 57 - Single-element Password Write Parameters

CSP File No.	N35
CIP Instance	28
Applies to	All models
No. of Elements	1
No. of Words	1
Data Type	Integer
Data Access	Write

Table 58 - Single-element Password Write

Element No.	Modbus Address	Element Name	Range	Description
0	40901	Password	0…9999	A write of this table allows any configuration parameter to be written as a single element or poke. The password stays active for 30 minutes and resets to another 30 minutes when a single element is configured.

Table 59 - User-configurable Table Setup Parameters

CSP File No.	N44
CIP Instance	29
Applies to	EM3 only
No. of Elements	17
No. of Words	17
Data Type	Integer
Data Access	Read/Write

Table 60 - User-configured Table Setup

Element No.	Modbus Address	Element Name	Default Value	Range	Description
0	41001	Password	0	0…9999	Required for configuration, returns -1.
1	41002	Selection for Parameter #1	29 (L1 Current)	0…110	
2	41003	Selection for Parameter #2	30 (L2 Current)		
3	41004	Selection for Parameter #3	31 (L3 Current)		
4	41005	Selection for Parameter #4	37 (L1-L2 Voltage)		
5	41006	Selection for Parameter #5	38 (L2-L3 Voltage)		
6	41007	Selection for Parameter #6	39 (L3-L1 Voltage)		
7	41008	Selection for Parameter #7	41 (Frequency)		
8	41009	Selection for Parameter #8	52 (Total Real Power)		
9	41010	Selection for Parameter #9	56 (Total Reactive Power)		
10	41011	Selection for Parameter #10	60 (Total Apparent Power)		
11	41012	Selection for Parameter #11	48 (3 Phase True Power Factor)		
12	41013	Selection for Parameter #12	70 (Real Energy Net (kWh))		
13	41014	Selection for Parameter #13	62 (Status 1 Count x1)		
14	41015	Selection for Parameter #14	64 (Status 2 Count x1)		
15	41016	Selection for Parameter #15	79 (Real Power Demand)		
16	41017	Selection for Parameter #16	8 (Status Input States)		

Table 61 - Parameters for Configurable Table

Parameter No.	Parameter Name	Description
0	None	No Parameter.
1	Date: Year	Refer to Date and Time Configuration table.
2	Date: Month	
3	Date: Day	
4	Time: Hour	
5	Time: Minute	
6	Time: Seconds	
7	Time: Hundredths	
8	Status Input States	Refer to Discrete Results table.
9	Output Word	
10	Wiring Status	Refer to Wiring Diagnostics Results table.
11	Voltage Input Missing	
12	Voltage Input Inverted	
13	Current Input Missing	
14	Current Input Inverted	
15	Voltage Rotation	
16	Current Rotation	
17	Voltage Phase 1 Angle	
18	Voltage Phase 1 Magnitude	
19	Voltage Phase 2 Angle	
20	Voltage Phase 2 Magnitude	
21	Voltage Phase 3 Angle	
22	Voltage Phase 3 Magnitude	
23	Current Phase 1 Angle	
24	Current Phase 1 Magnitude	
25	Current Phase 2 Angle	
26	Current Phase 2 Magnitude	
27	Current Phase 3 Angle	
28	Current Phase 3 Magnitude	
29	L1 Current	Refer to Volts, Amps, Frequency Results table.
30	L2 Current	
31	L3 Current	
32	Average Current	
33	L1-N Volts	

Table 61 - Parameters for Configurable Table

Parameter No.	Parameter Name	Description
34	L2-N Volts	Refer to Volts, Amps, Frequency Results table.
35	L3-N Volts	
36	Average L-N Volts	
37	L1-L2 Volts	
38	L2-L3 Volts	
39	L3-L1 Volts	
40	Average L-L Volts	
41	Frequency	
42	Percent Current Unbalance	
43	Percent Voltage Unbalance	
44	Metering Iteration	
45	L1 True Power Factor	Refer to Power Results table.
46	L2 True Power Factor	
47	L3 True Power Factor	
48	3 Phase True Power Factor	
49	L1 kWatts	
50	L2 kWatts	
51	L3 kWatts	
52	Total kWatts	
53	L1 kVAR	
54	L2 kVAR	
55	L3 kVAR	
56	Total kVAR	
57	L1 kVA	
58	L2 kVA	
59	L3 kVA	
60	Total kVA	
61	Status 1 Count xM	Refer to Energy Results table.
62	Status 1 Count x1	
63	Status 2 Count xM	
64	Status 2 Count x1	
65	GWh Fwd	
66	kWatth Fwd	
67	GWh Rev.	
68	kWatth Rev.	
69	GWh Net	

Table 61 - Parameters for Configurable Table

Parameter No.	Parameter Name	Description
70	kWatth Net	Refer to Energy Results table.
71	GVARH Fwd	
72	kVARh Fwd	
73	GVARH Rev.	
74	kVARh Rev.	
75	GVARH Net	
76	kVARh Net	
77	GVAh Net	
78	kVAh	
79	kWatt Demand	Refer to Demand Results table.
80	kVAR Demand	
81	kVA Demand	
82	Demand PF	
83	Projected kWatt Demand	
84	Projected kVAR Demand	
85	Projected kVA Demand	
86	Elapsed Demand Period Time	
87	Bulletin Number	Refer to Unit Run Status Results table.
88	Series Letter	
89	Catalog Device Type	
90	Communication Type	
91	Application FRN	
92	Boot Code FRN	
93	Default Device ID	
94	Accuracy Class	
95	Overall Status	
96	Flash Memory	
97	SRAM	
98	NVRAM	
99	SPI Interface	
100	Real Time Clock	
101	Watchdog Timer	
102	Metering	
103	LCD Interface	
104	Serial Communications	
105	Ethernet Communications	
106	Input Over Range	Refer to Unit Run Status Results table.
107	Phase Loss Detection	
108	Terminal Locked	
109	Password Accepted	
110	Error Recorded	

SCADA Applications

This section covers RSLinx driver setup, and OPC setup using the RSLinx OPC Server.

RSLinx Classic Drivers Configuration

The PowerMonitor 1000 unit EDS file should be installed on the computer running RSLinx software before configuring drivers. RSLinx software supports DF1 half-duplex, DF1 full-duplex, and EtherNet/IP network communication.

Configure DF1 Half-duplex Slave

You need to use a RS232 to RS485 converter like the 1761-NET-AIC or B&B Electronics Converter – Model 485SD9TB.

1. Create a DF1 Polling Master Driver in RSLinx software.
2. Verify that the communication rate in the Port Configuration tab is the same as the communication rate set for your power monitor.
3. Set the Error Checking Mode in the DF1 Protocol Settings tab to CRC.
4. Set the Destination Station Out-of-List Strategy in the Polling Strategies tab to Allow Msgs to Stns that are not in lists.
5. Perform an RSWho to verify that RSLinx software is communicating to the power monitor.

   RSLinx software driver configuration is complete.

Configure DF1 Full-duplex

You need to use a RS232 to RS485 converter, like the 1761-NET-AIC or B&B Electronics Converter – Model 485SD9TB.

1. Create a RS232 DF1 devices driver in RSLinx software.
2. Perform an Auto-configure.
3. Verify connections if Auto-configure fails.
4. Perform an RSWho to verify that RSLinx software is communicating to the power monitor.

   RSLinx software driver configuration is complete.

Configure RSLinx Software Driver Configuration for DH485

You need to use an RS232 to RS485 converter like the 1761-NET-AIC converter or B&B Electronics Converter - Model 485SD9TB.

1. Open the RSLinx Launch Control Panel.
2. Start RSLinx software to run as normal application, not as service.
3. Create a 1747-PIC/AIC+ Driver in RSLinx software.
4. Verify that the communication rate is the same as the communication rate set for your power monitor.
5. Set the node address and maximum node address of RSLinx Driver.
6. Perform an RSWho to verify that RSLinx software is communicating to the power monitor.
7. Restart RSLinx software to run as service.

Configure EtherNet/IP Network Using Ethernet Devices Driver

1. Create an Ethernet devices driver in RSLinx software.
2. Add the IP address of the power monitor to the driver station mapping.
3. Perform an RSWho to verify that RSLinx software is communicating to the power monitor.

   RSLinx software driver configuration is complete.

Configure EtherNet/IP Network Using EtherNet/IP Driver

1. Create an Ethernet/IP driver in RSLinx software.
2. Make selections to browse the local or remote subnet as appropriate.
3. Perform an RSWho to verify that RSLinx software is communicating to the power monitor.

   RSLinx software driver configuration is complete.

IMPORTANT	The power monitor makes a connection to either the RSLinx Ethernet Devices driver or the Ethernet/IP driver on a single computer but not both simultaneously.

RSLinx Classic Software OPC Server Setup

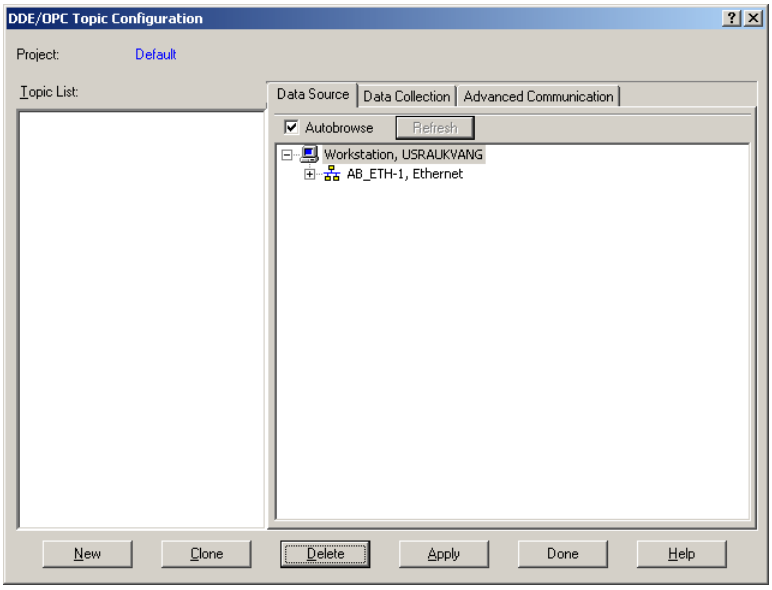
You can set up RSLinx software as an OPC Server to serve data from a power monitor to an OPC 2.0 compliant application. You must first set up an RSLinx driver to communicate to the power monitor. You can then create an OPC topic to serve data to your SCADA application.

Set Up OPC Topic

Follow these steps to set up a DDE/OPC topic in RSLinx software for the power monitor.

1. Open RSLinx software.
2. From the DDE/OPC menu, choose Topic Configuration**.**

This configuration window appears.



3. Click New.

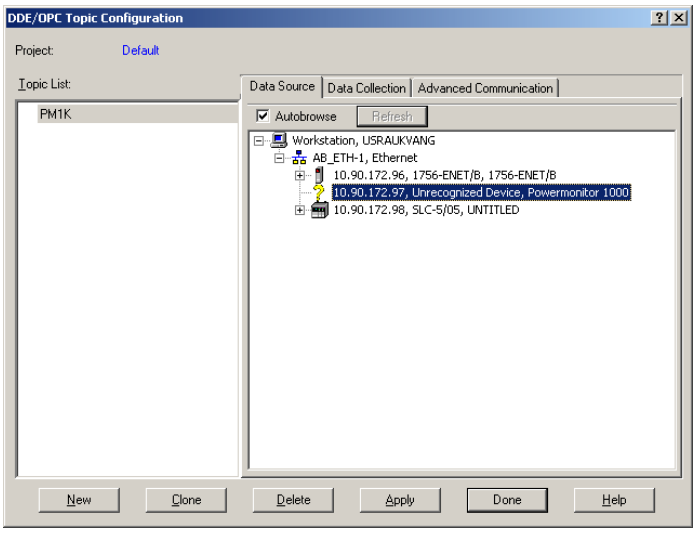
   This creates a topic in the left hand pane.

4. Name the topic pertinent to your application.

5. In the right hand pane, under the Data Source tab, browse to your power monitor.

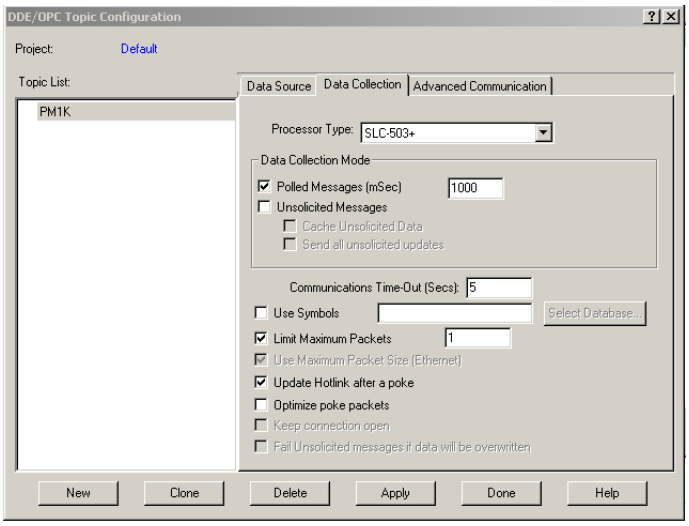
   You may use a serial or Ethernet network driver.

   TIP When using a DH485 driver, change the connection type to local addressing mode in the Advanced Communication tab. This is especially important when several topics use the DH485 driver.



6. Make sure that the topic is highlighted in the left pane, and that the power monitor is also highlighted in the right pane, then click Apply.
7. Click the Data Collection tab.

8. From the Processor Type menu, choose SLC 503+.



9. Click Done.

   OPC Topic configuration is complete.

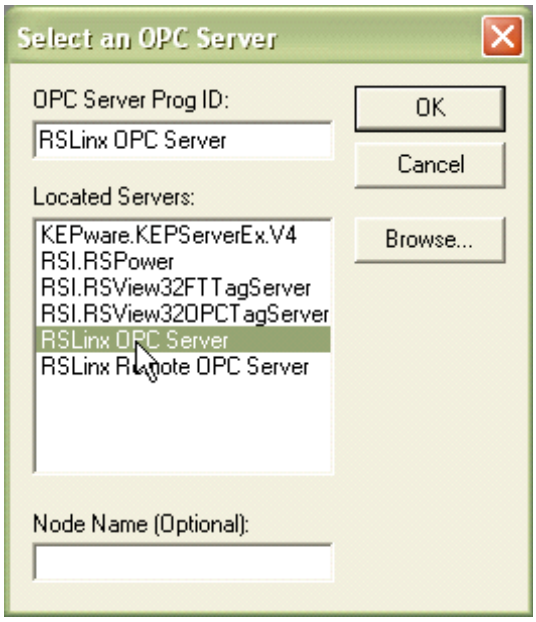
You can now use the RSLinx OPC Server, and the topic just created, to serve data to your application.

OPC item addresses are of the format [OPC Topic Name]Address,Ln,C1 where Address is the power monitor data address (example: F21:7). Optional argument Ln is the length of the array requested in elements. If the Ln argument is used, C1 (number of array columns) must also be specified.

Browse OPC Tags

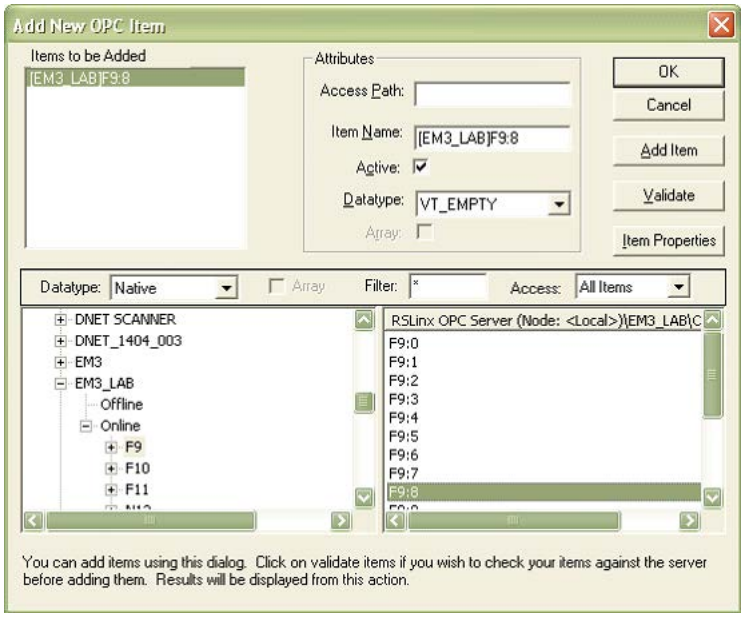
The power monitor supports OPC tag browsing. The example uses the RSI OPC Test Client to illustrate tag browsing.

1. Open the RSI Test Client and connect to the RSLinx Classic OPC Server.



2. Add a group, then add an item. Browse to the OPC topic and then to the table and element in the Online tags.

   In this example, the User Configured Read Instance F9, element 8, in the OPC topic EM3_LAB is selected.



3. Click OK and start viewing data.

User-configured Data Table

The 1408-EM3 model provides a user configured data table. You may select the 16 floating-point parameters that comprise this table. Your application may read this table as connected input instance 1, or as CSP file F9 using explicit messaging.

Setup

You must use serial or Ethernet network communication to set up and read the user configured data table.

To set up the user configured table, using explicit messaging, write a new configuration to the User Configured Table Setup table.

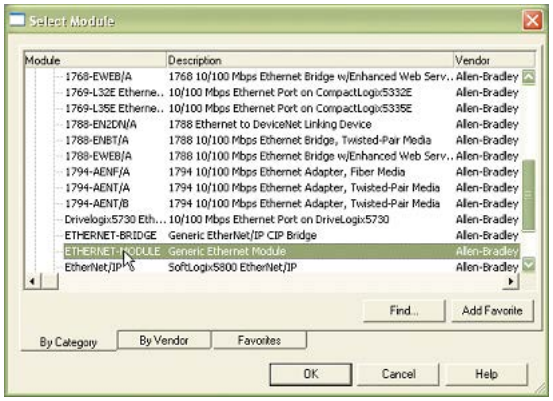
See page 111 for the content, default parameters and addressing details of the setup table. Pages 112...114 list the available selections for the parameters.

Reading the User Configured Table as Connected Instance 1

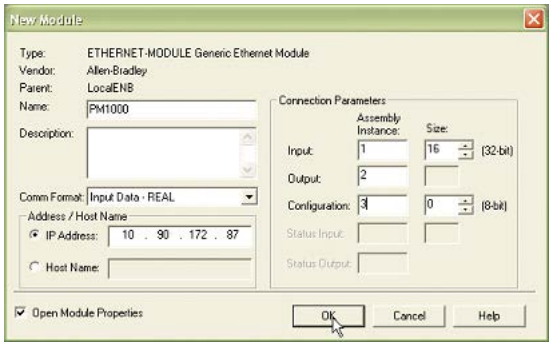
The following example illustrates the steps required to set up an I/O connection between a Logix controller and the user configured Instance 1. The example uses a CompactLogix controller and RSLogix 5000 software.

Follow these steps to configure the connection.

1. Open an offline project in RSLogix 5000 software.
2. Open the Ethernet network interface and select the Ethernet network.
3. Add a new module and choose Generic Ethernet Module from the Communication group.



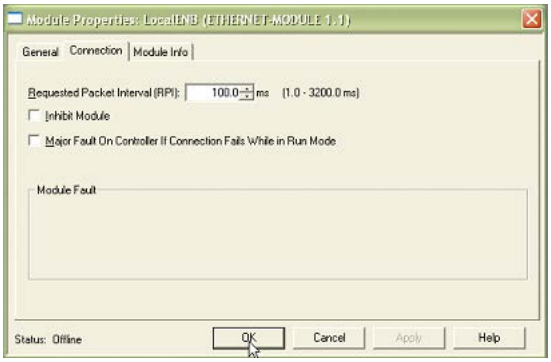
4. Configure the properties of the new module and click OK.



Parameter	Choice
Name	Your choice of name
Comm Format	Input Data - REAL
IP Address	The IP address of your power monitor
Input	Assembly Instance 1; Size 16 (32-bit)
Output	Assembly Instance 2
Configuration	Assembly Instance 3; Size 0
Open Module Properties	Leave checked

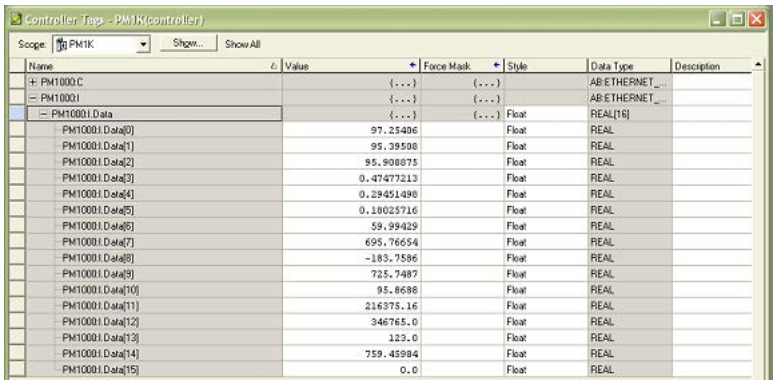
5. On the connection tab, enter the desired Requested Packet Interval (RPI).

Do not enter an RPI less than 50 mS.



6. Click OK, then Save and download the offline project into the controller.

The data from the user configured table is read into the controller tag [Module Name]:I.Data without any further logic programming, at the selected RPI rate.



A power monitor connected instance may be owned by only one controller. An error results if you attempt to establish a connection with more than one controller. You may use explicit messaging to read the F9 table from any number of controllers.

Specifications

Technical Specifications

Table 62 - Technical Specifications - 1408-TR1A-*xxx*, 1408-TR2A-*xxx*, 1408-EM1A-*xxx*, 1408-EM2A-*xxx*, 1408-EM3A-*xxx*

Attribute	Accuracy in % of Reading at 25 °C (77 °F) 50/60 Hz Unity Power Factor						Nominal / Range
		Applies to					
		TR1	TR2	EM1	EM2	EM3	
Voltage sense inputs: V1, V2, V3	±0.5%	X	X			X	Line-neutral rms: 347V / 15…399V Line-line rms: 600V / 26…691V
Current sense input: I1, I2, I3	±0.5%	X	X			X	5A / 0.05…10.0A rms
Frequency	±0.05 Hz	X	X			X	50 or 60 Hz / 40…75 Hz
Power functions: kW, kVA, kVAR	EN62053-21:2003 Accuracy Requirement Class 1(1)		X			X	
Demand functions: kW, kVA					X	X	
Energy functions: kWH, kVAH				kWh only	X	X	
Metering update rates	100 mS V, I, Hz 200 mS Power	X	X	X	X	X	

(1) Fast transient external influence tested at 2 kV.

Table 63 - Input and Output Specifications - 1408-TR1A-*xxx*, 1408-TR2A-*xxx*, 1408-EM1A-*xxx*, 1408-EM2A-*xxx*, 1408-EM3A-*xxx*

Attribute	Value
Control power	85…264V AC 47…63 Hz 125…250V DC 4 VA max
Voltage sense inputs: V1, V2, V3	Input impedance: 5 M Ω min Input current: 2 mA max
Current sense inputs: I1, I2, I3	Overload withstand: 15 A continuous, 200 A for 1/2 s Burden: 0.05V A Impedance: 0.002 Ω Max crest factor at 5 A is 3.0 Starting current: 5 mA
Status inputs	Contact closure (internal 24V DC)
KYZ output	80 mA at 240V AC / 300V DC

Table 64 - Environmental Specifications - 1408-TR1A-*xxx*, 1408-TR2A-*xxx*, 1408-EM1A-*xxx*, 1408-EM2A-*xxx*, 1408-EM3A-*xxx*

Attribute	Value	
Dielectric withstand	Control power	2500V
	Voltage inputs	2500V
	Current inputs	2500V
	Status inputs	2500V
	KYZ output	2500V
Terminal blocks	0.34…2.5 mm^2 (22…14 AWG), 75 °C (167 °F) min copper wire only Recommended torque 0.8 N•m (7 lb•in)	
Operating temperature	-10…60 °C (14…140 °F)	
Storage temperature	-40…85 °C (-40…185 °F)	
Humidity	5…95%, noncondensing	
Vibration	2.0 g 10…500 Hz	
Shock	30 g peak each axis (operating) 50 g peak each axis (nonoperating)	

Certifications

The power monitor adheres to these certifications.

EtherNet/IP Network Conformance Testing

All power monitor products equipped with an EtherNet/IP network communication port bear the mark shown. This mark indicates the power monitor has been tested at an Open Device Vendor Association (ODVA) independent test lab and has passed the EtherNet/IP network conformance test. This test provides a level of assurance that the power monitor will interoperate with other conformance tested EtherNet/IP network devices (including devices from other vendors). One representative device from the power monitor EtherNet/IP network family of devices; the 1408-EM3-ENT has been tested by ODVA using EtherNet/IP Conformance Test, version A2.8. The ODVA website http://www.odva.org maintains a list of products that have passed the conformance test at one of their test labs.

UL/CU-L

UL 508 listed, File E56639, for Industrial Control Equipment and C-UL Certified.

CE Certification

If this product bears the CE marking, it is approved for installation within the European Union and EEA regions. It has been designed to meet the following directives.

EMC Directive

This product is tested to meet Council Directive 89/336/EEC Electromagnetic Compatibility (EMC) and the following standards, in whole, documented in a technical construction file.

EN55011 – Radiated Electromagnetic Emissions

EN55011 – Conducted Emissions

ENV50204 – RF 900MHz Keyed Carrier

EN61000 – Immunity

This product is intended for use in an industrial environment.

Low Voltage Directive

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN61010-1.

This equipment is classified as open equipment and must be installed (mounted) in an enclosure during operation as a means of providing safety protection.

International Standard IEC 529 / NEMA / UL 508 Degree of Protection

The Bulletin 1408 PowerMonitor 1000 unit is rated as IP10 degree of protection per International Standard IEC 529. It is considered an open device per NEMA and UL 508.

Follow the recommended installation guidelines to maintain these ratings.

ANSI/IEEE Tested

Meets or exceeds the Surge Withstand Capability (SWC) C37.90.1 - 2002 for protective relays and relay systems on all power-connection circuit terminations.

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Rockwell Automation provides technical information on the Web to assist you in using its products. At http://www.rockwellautomation.com/support you can find technical and application notes, sample code, and links to software service packs. You can also visit our Support Center at https://rockwellautomation.custhelp.com/ for software updates, support chats and forums, technical information, FAQs, and to sign up for product notification updates.

In addition, we offer multiple support programs for installation, configuration, and troubleshooting. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/services/online-phone.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/rockwellautomation/support/overview.page, or contact your local Rockwell Automation representative.

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Rockwell Automation tests all of its products to help ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

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Publication 1408-UM001D-EN-P - September 2013
Supersedes Publication 1408-UM001C-EN-P - June 2011

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